Draft Environmental Impact Statement

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WESTERN ENERGY COMPANY
ROSEBUD MINE Area D

Montana Department of State Lands / U.S. Department of the Interior

OSM-EIS-19

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Type of Statement: Draft Environmental Impact Statement

Lead Agencies:

State of Montana, Department of State Lands
U.S. Department of the Interior, Office of Surface Mining, Reclamation and Enforcement

Proposed Action:

Approvals to mine 3,073 more acres (known as Area D) of Western Energy Company's Rosebud Mine.

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NRIS 96

Draft

ENVIRONMENTAL IMPACT STATEMENT

WESTERN ENERGY COMPANY'S
ROSEBUD MINE
AREA D

January 1985

Montana Department of State Lands

Dennis Hemmer, Commissioner

U.S. Office of Surface Mining

John Ward, Director

OSM-EIS-19

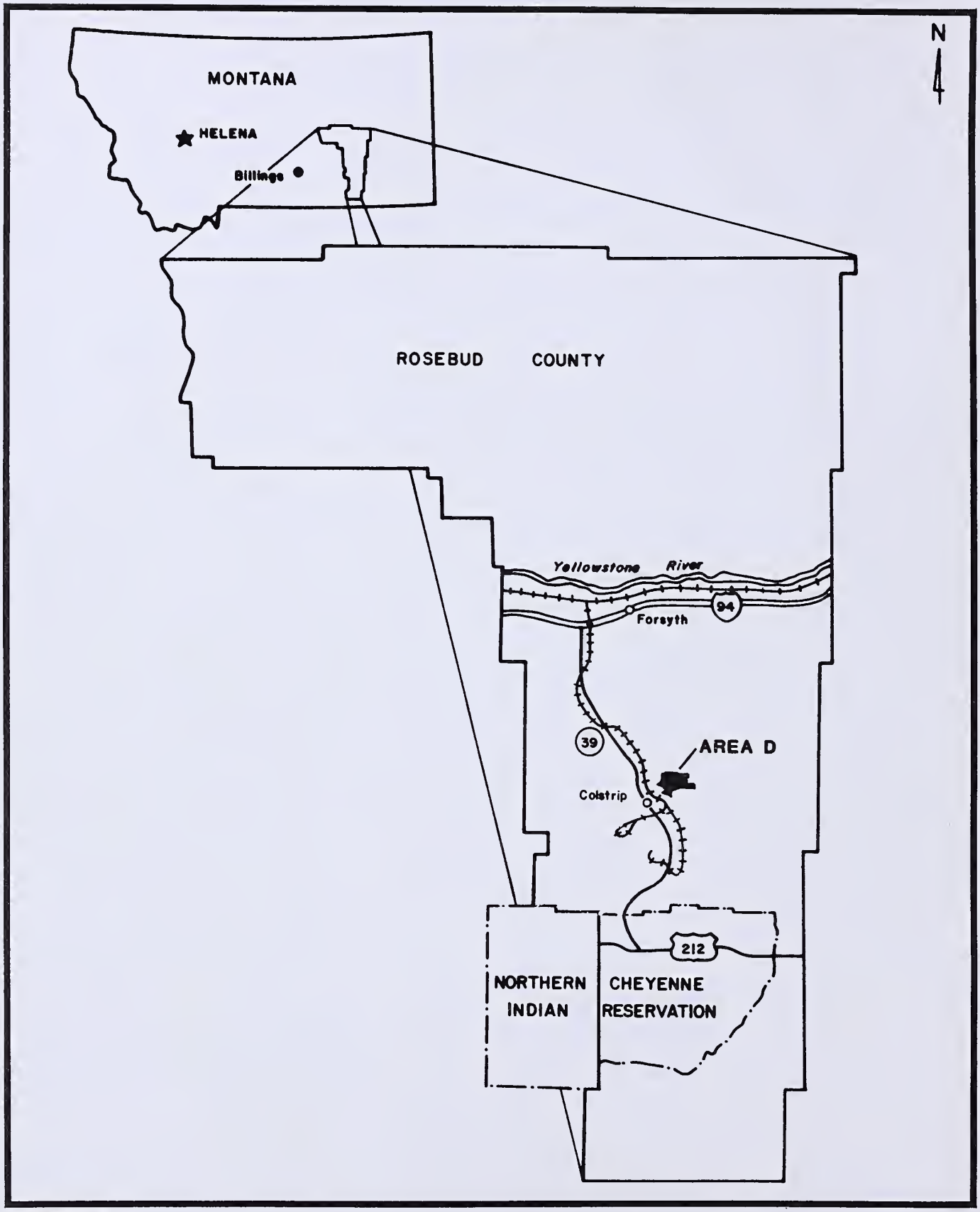

FIGURE S-1

Area D lies just northeast of Colstrip and 35 miles from Forsyth, the Rosebud County seat. The largest city nearby is Billings, 120 miles away.

ROSEBUD MINE

AREA D

Action under Consideration

Western Energy Company has submitted an application to mine an additional 3,073 acres, known as Area D, at the Rosebud Mine (fig. S-1). The Commissioner of the Montana Department of State Lands and the Secretary of the Department of the Interior are required to make a decision on whether to issue the necessary approvals for mining.

The Company's Proposal

Western Energy proposes to mine an additional 68.5 million tons of coal in the application area. Mining would take place over 18 years at an average rate of 3.8 million tons per year. If the application is approved, the company could begin operations in the new area in 1985.

Along with the application, the company has submitted future plans for an eastward and westward extension of Area D, known as the life-of-mine expansion. The expansion is not a part of Western Energy Company's application for approval to mine. The life-of-mine plan, however, is analyzed to display the cumulative impacts of mining. In the future plans, the company would mine an additional 19.3 million tons of coal from 1,309 acres. The expanded mine would close at the end of 23 years.

Summary of Impacts

Geology: Impacts on geology would not be significant. The postmining topography would approximate the existing topography, but would be gentler, with lower hilltops and broader drainage bottoms. With successful revegetation of the disturbed area, erosion rates would be similar to, or less than, premining rates. Minor ephemeral tributaries not restored during reclamation may redevelop as gullies. This would not affect postmining land use and would not release a significant amount of sediment downstream.

Overburden physical and chemical characteristics are not expected to adversely affect postmining revegetation success.

Hydrology: Mining in the application area would dewater the Rosebud coal aquifer by intercepting ground water now discharging to the upper Cow Creek watershed. Dewatering could reduce alluvial aquifer flow by 1.5 to 3.0 percent. Mining would also remove five wells and three seeps in the application area and possibly reduce flows and water quality in three nearby springs, two beside the application area and one beside the life-of-mine expansion. After mining, Western Energy would drill three sub-McKay wells to replace the wells and one of the potentially affected adjacent springs.

A spoil aquifer would develop with an anticipated total dissolved solids (TDS) concentration two to three times the concentrations now in the Rosebud coal and overburden. Spoil water would discharge to upper Cow and Pony

creeks. Reclamation of unreclaimed Northern Pacific spoil next to Area D would decrease the total volume of spoil water discharging to Cow Creek. The result of increased TDS concentrations and decreased volume would be an increase in TDS concentrations in Cow Creek alluvial water by 1 to 2 percent from mining in the application area and 2 to 3 percent from mining in the life-of-mine expansion. Impacts overall would not be significant.

Soils: Some impacts to the soil resource would occur during soil salvage, storage, and replacement. These include reduction of soil porosity, alteration of soil structure, and dilution of organic matter levels in the near-surface horizon. Microbial activity would be reduced, at least temporarily, in the reconstructed mine soil. Increased rates of soil loss by wind and water erosion can be expected prior to the reestablishment of vegetation. Overall, impacts to soils would not be significant.

Vegetation: During reclamation, Western Energy would replace the major pre-mining vegetation types. The only exception would be the 120 acres of cropland, which would be converted to rangeland. Conversion of cropland and other areas (e.g., mine spoil, disturbed grassland, ponds, and ranchyard) to rangeland would increase grazing capacity.

Mining and reclamation would decrease species diversity and create a less complex mosaic of vegetation for several decades after mining. Ponderosa pine (*Pinus ponderosa*) stands with diverse canopy and tree size characteristics would also be lost for several decades, or longer. If reestablishment of ponderosa pine is unsuccessful, the loss would be a significant impact, since 49 percent of the ponderosa pine vegetation type of the Rosebud Mine occurs on the Area D application area and life-of-mine expansion. Otherwise, impacts would not be significant.

Wildlife: Major direct impacts to most wildlife would be temporary and limited to the area of disturbance. Wildlife species dependent upon ponderosa pine, shrub, and grassland habitats would lose nests, forage, and shelter until these habitats could be reestablished. Also lost until successful reclamation would be habitat for pronghorn, predators, turkeys, songbirds, raptors, and sharptail grouse.

Climate: Mining in Area D would not affect the climate. Particulate emissions would remain at or near ground level, and total emissions would be too small to affect either precipitation or radiation balance.

Air Quality: Total suspended particulate concentrations in the Colstrip area would change little due to mining in either the Area D application area or life-of-mine expansion.

Employment and Income: The jobs provided by mining over the life of Area D would replace those phased out in Area E. No new jobs would be created.

Social Conditions: Since Area D would not create new jobs, it would not increase the population of Rosebud County, Colstrip, or Forsyth. The population of Rosebud County, Colstrip, and Forsyth peaked in 1982 and 1983. It is projected to decline through 1986 and remain relatively stable thereafter. The

population attributable to Area D would account for approximately 30 percent of all direct coal-related population in Rosebud County. Area D employment would contribute to the stability of Colstrip's social life, especially during the period of population decline after the completion of Colstrip Generating Units 3 and 4.

Social and Community Services: The strain placed on Colstrip's and Rosebud County's social and governmental services in the past is over. Service expansions and improvements coupled with a declining construction population have combined to create a service system sufficient for the area's needs. Each community service has idle capacity and could absorb additional clients. The population related to Area D already resides in the area and does not constitute a new population to be served.

Fiscal Conditions: Mining would generate $304.6 million in tax revenues for local school districts and county, state, and federal governments over the life of Area D.

Land Use: Mining of the Area D application area and life-of-mine expansion would temporarily suspend grazing on a maximum of 2,110 acres of rangeland and eliminate wheat and hay production on approximately 120 acres. This impact would be minor.

Transportation: Area D would not noticeably change either train or highway traffic levels in Rosebud County.

Recreation: Since Area D would not increase population, no impact on recreation facilities or sites in or near Colstrip is expected.

Cultural Resources: One prehistoric site eligible for listing on the National Register of Historic Places may be disturbed by vandalism and theft during mining in the application area. Six additional sites would be destroyed by mining in the life-of-mine expansion.

Aesthetics: Western Energy's operations would initially destroy the landscape of the mine area. After mining, reclamation would blend the minesite with surrounding lands. In the long term, as ponderosa pine woodlands regrow, aesthetic impacts would not be significant.

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THE EIS: WHY IT IS WRITTEN
WHO TAKES PART
WHAT DECISIONS MUST BE MADE

Western Energy Company proposes to expand the Rosebud Mine into Area D. The mine is located in Rosebud County, just northeast of Colstrip. Western Energy must obtain approval from the Montana Department of State Lands, in accordance with the Montana Strip and Underground Mine Reclamation Act, and the U.S. Department of the Interior, Office of Surface Mining, in accordance with the Surface Mining Control and Reclamation Act. If approved, mining in the application area would begin in 1985.

THE EIS

The Department of State Lands (DSL) and the U.S. Department of the Interior (DOI) have determined that a decision on Western Energy's application may "significantly affect the quality of the human environment." Therefore, before making a decision on the company's application, DSL and DOI are required to prepare an environmental impact statement (EIS) (Montana Environmental Policy Act [MEPA], 1971, and National Environmental Policy Act [NEPA], 1969). Within DOI, the Office of Surface Mining, Reclamation and Enforcement (OSM) is the lead agency.

As directed by MEPA and NEPA, DSL and DOI will--

(1) issue this draft EIS.

(2) encourage and accept public comments on the draft.

(3) issue a final EIS that contains--

(a) corrections or clarifications of the draft text and

(b) responses to public comments.

After publishing the final EIS, DSL and DOI must make a decision on Western Energy's application. The Department of State Lands can make a decision no sooner than 15 days following publication of the final EIS; DOI can make a decision no sooner than 30 days following publication by the U.S. Environmental Protection Agency that the final EIS is available for public review and comment.

The EIS analyzes (1) the company's proposal, (2) the lands, people, and resources that the proposal would affect, and (3) the consequences (or impacts) of the proposal. The EIS does not present DSL's or DOI's decision. The document is used as one of the tools in making the decisions. The preparation of the EIS helps ensure the proposed operation is well planned, that the environmental impacts of the proposed action are analyzed, and that the concerns of all agencies, organizations, and citizens are considered before a decision is made.

PREVIOUS DOCUMENTS AND RESEARCH

This EIS analysis draws data from many sources. Each source is listed under Literature Cited at the end of the EIS. Two of these documents deserve special mention here.

Of primary importance to the EIS is Western Energy's application for a new mining permit (Western Energy Company, 1984). The application, a 10-volume set accompanied by reports on individual topics, contains detailed, comprehensive data on most of the subjects in the EIS. The data, collected over the last decade, range broadly, covering such subjects as hydrology, vegetation, soils, archaeological sites, wildlife, and aquatic ecology. Much of the information found in the EIS comes from information and analyses in (or incorporated by reference in) the permit application. For those interested, the application is available for review at the Department of State Lands, Helena and Billings, the Office of Surface Mining, Denver, and the office of the Rosebud County Clerk and Recorder.

Also important to the EIS is the Rosebud Mine Comprehensive Environmental Impact Study, published in final form in July 1983. The comprehensive study contains information on the cumulative effects of mining the entire Rosebud Mine, including Area D. For further information on the mine, the reader is directed to the comprehensive study, which may be obtained from the Department of State Lands, Capitol Station, Helena, Montana 59620, and is hereby incorporated into the EIS by reference. A summary of the cumulative impacts of the entire mine is included in this document as appendix C.

SCOPE OF ANALYSIS

The EIS analyzes both the immediate and cumulative effects of Western Energy's mining and reclamation plan. Included in the analysis are the impacts the mine would have on the physical environment--on soils, vegetation, water quality, air quality, and a number of other resources. Also included are impacts on the human environment--on land use, fiscal conditions, social conditions, and cultural resources. The text generally covers both the impacts directly from mining and those resulting from increases in employment and economic activity.

The EIS analyzes two levels of mine development: (1) Western Energy's application (18-year) mine plan, for which a permit application has been submitted and (2) the life-of-mine (23-year) plan, an operation that extends the mine both east and west.

The scope of the EIS was established by DSL, OSM, and the public. In June 1984, DSL and OSM mailed 350 questionnaires to interested persons to obtain public comment on the proposed mine and to help identify any significant issues which would have to be addressed in an EIS. A notice of intent to prepare a draft EIS, including a request for public participation in the determination of the scope of the issues, was published in the Federal Register. Public concerns expressed in the eight responses to the questionnaire and the Federal Register notice are listed below.

- Would Area D affect any threatened or endangered species?
- Would Area D affect any nesting migratory birds or their habitats?
- Would salt movement and subsurface infiltration affect the area above the water table?
- How would mining affect recharge areas critical to downstream reaches in the Colstrip vicinity?
- How would mining affect nearby wells?
- How would mining affect surface water in the Pony, Cow, and Spring Creek drainages?
- Would reclamation be able to return lands to small grains production?
- Would reclamation successfully establish deciduous shrub and ponderosa pine communities in the headwaters of Pony and Spring Creeks?
- What mining methods would the company use?
- What safety would there be for miners?
- How would the landscape be restored?
- How would Area D affect air quality?

The analysis in the EIS is a projection of what would happen if the mine opens and if certain "assumptions" about the future (the 18-year plan, the 23-year plan) are correct. An example of an assumption is the mine employment schedule contained in chapter III, Employment and Income. Another example is the amount of coal to be mined each year, listed in chapter I. The projections, based on the assumptions, are accurate. But the future, as always, is uncertain.

AGENCY RESPONSIBILITIES

A number of agencies have participated in the writing or review of this EIS and several will also participate in the issuance of permits necessary for the proposed mining operation.

Montana Department of State Lands

The Department of State Lands (DSL) administers the Montana Strip and Underground Mine Reclamation Act (82-4-201 et seq. MCA), under which Western Energy has applied for a permit. The act provides for protection of environmental and cultural resources in and around the proposed mining area.

The strip mine act was passed in 1973. It requires that a company intending to remove coal first obtain a permit from the Department of State Lands. In its permit application a company must submit a plan that meets all the requirements of the act. For instance, the plan must show that the company will salvage and replace all topsoil; restore the mined land to the approximate premining contour; plant a permanent and diverse cover of vegetation composed mainly of native species; protect alluvial valley floors; and preserve the essential hydrologic functions of streambeds.

Typically, after receipt of an application, the Department issues a "deficiency" letter. The letter points out to the company the parts of the mine plan that do not meet the law. The company then changes the plan. Through frequent meetings and the use of the deficiency letter (and often a second letter), the mine plan is continually improved. When the plan has adequately addressed all provisions of the law, the Department makes its decision.

Office of Surface Mining

In 1977 Congress passed the Surface Mining Control and Reclamation Act (SMCRA). The Department of the Interior, Office of Surface Mining (OSM), administers the act. Under SMCRA, DSL developed a "permanent regulatory program," which delegated to DSL on April 1, 1980, the responsibility for regulating coal mining on private lands. Through a cooperative agreement, OSM then delegated its regulatory authority to DSL for federal lands.

Although the Department of the Interior has thus delegated its regulatory authority, it cannot, under SMCRA or the Mineral Leasing Act, delegate its responsibility to approve mining plans, carry out the provisions of the National Environmental Policy Act, or to comply with other laws, regulations, and executive orders pertaining to coal mining. Moreover, even though DSL is now the main agency regulating coal mining in Montana, OSM oversees DSL's work to be sure the regulatory program complies with SMCRA. As part of its responsibility under the National Environmental Policy Act, OSM is also cooperating with the Department in writing this EIS.

Montana Department of Health and Environmental Sciences

Western Energy has applied to the Air Quality Bureau of the Department of Health and Environmental Sciences for an amendment to its air quality permit (No. 1483) for the Rosebud Mine. The amended permit would be extended to cover emissions from Area D's surface operations. Emissions from the coal-processing facilities, located in Area E, are covered in the existing permit.

Western Energy must obtain an MPDES (Montana Pollutant Discharge Elimination System) surface water permit from the Water Quality Bureau. The permit would cover surface water discharges from pits and ponds. Discharges would have to meet effluent limitations and water quality standards established by the Montana Board of Health and Environmental Sciences.

State Historic Preservation Office

The State Historic Preservation Office has the responsibility to cooperate with and to advise the Department of State Lands when potentially valuable historical, archaeological, or other cultural resources are located in a project area (Montana Strip and Underground Mine Reclamation Act [MCA 82-4-201 through 82-4-228], the Montana Antiquities Act [MCA 22-3-401 through 22-3-442], and the National Historical Preservation Act [P.L. 89-665 as amended and reauthorized by Executive Order 11593]). Part of the advice given to the Department may include comments on a company's plan for impact mitigation of sites eligible for nomination to the National Register of Historic Places. The office also reviews the EIS to ensure compliance with cultural resource regulations.

Prior to mining, the State Historic Preservation Office is responsible for issuing antiquities permits for projects on state-owned lands. The office seeks determinations from the Keeper of the National Register for sites believed to be eligible for listing on the National Register of Historic Places. During mine operation, the Department of State Lands is responsible for monitoring compliance with historic preservation and monitoring plans.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service administers the Endangered Species Act, as reauthorized in 1982, and the Bald Eagle Protection Act of 1940 (as amended). Federal agencies (in this case, the Office of Surface Mining) involved in actions potentially affecting threatened or endangered species must prepare a biological assessment to comply with the Endangered Species Act. If the assessment determines impacts would adversely affect threatened or endangered species, the preparing agency consults with the Fish and Wildlife Service to find measures to protect the affected species.

ALTERNATIVES UNDER CONSIDERATION

DSL and DOI have analyzed five alternatives that bound the range of decisions available to the agencies.

1. Approve the Application as Proposed

The environmental effects of approving the application are contained in chapter III.

2. Reject the Application

The Department or OSM may reject an application that does not meet the requirements of the permanent regulatory program. The effects of rejection are described in chapter IV.

3. Selectively Rejecting Approval

DSL or DOI can reject approval for mining specified areas. The specified areas would include, for example, those having special, exceptional, critical, or unique characteristics, or where mining would affect the use, enjoyment, or fundamental character of neighboring land having the above special characteristics (82-4-227 MCA). The specified areas could also include those that could not meet state and federal reclamation standards.

DSL and OSM have not at this time identified any lands for selective rejection, but that does not preclude such action following review of this EIS. The public is invited to comment on this alternative and if such areas are identified, they will be analyzed in the final EIS.

4. Approve Mining with Special Conditions (Preferred Alternative)

If parts of the proposed plan were considered unacceptable, DSL and DOI could approve mining with special conditions. Modifications identified in this EIS that would reduce the impacts of the mine are listed as separate sections at the end of each subject in chapter III. These sections are titled "Mitigating Measures."

5. No Action

The no-action alternative was evaluated by OSM and determined not to be reasonable because the company has fulfilled the requirements of its federal lease and has filed a complete permit application with OSM. Therefore, a decision by the Secretary of the Interior regarding approval of the mining plan and issuance of a federal permit to mine coal is required by law. However, for OSM, the impacts to the human environment of implementing the no-action alternative would be the same as those of rejecting the application. Thus, for the purpose of this EIS, these alternatives are considered equivalent and the no-action alternative is not analyzed further.

COMPARISON OF ALTERNATIVES CONSIDERED

DSL and DOI are now considering three alternatives: approve the application as submitted, reject the application, or approve the application with special conditions. Approving the application as submitted would have many impacts, but most would be minor. Among the impacts:

- The replacement of five wells and three seeps destroyed by mining with three wells.
- A 5-percent increase in total dissolved solids concentrations in the alluvial water of the upper reaches of Cow Creek.
- The unavoidable short-term impacts on soils, including a reduction in soil porosity, a breakdown of structure, a dilution of organic matter, and a reduction in microbial activity.

- The elimination of 120 acres of cropland.
- The potential loss, at least in the short term, of ponderosa pine forests, plant diversity, and the complex mosaic of vegetation types.
- The temporary loss of 3,465 acres of wildlife habitat.
- The destruction of six cultural resource sites.

Approval of the proposal with special conditions would have many of these same impacts. However, to the extent that special conditions are imposed, the impacts would be reduced.

Application rejection would eliminate many of the detrimental impacts of application approval. But the rejection would create other adverse effects:

- The loss of up to 130 jobs.
- A decline in the population of Colstrip and Rosebud County as a result of the job loss.
- The loss of $304.6 million in tax revenues that would otherwise go to county, state, and federal governments.

OTHER ALTERNATIVES

Technical Alternatives

DSL and OSM also considered alternative ways of mining the coal at the Rosebud Mine, but other methods are either impractical or inferior to the proposed dragline strip-mining operation proposed by Western Energy. As a result, no alternative mining methods have been analyzed in detail in this EIS. Alternative mining methods considered but rejected include auger mining, underground mining, and truck-and-shovel mining.

Although practiced in some nearby mines, truck-and-shovel mining has one major drawback: high cost. Where the company must selectively handle toxic overburden, truck-and-shovel mining may be preferred, despite the cost. At the Rosebud Mine, this is not the case.

Underground mining has several disadvantages. Although an underground method would not disturb the soil and rock strata overlying the coal, the land surface could subside after mining, as the underground mine workings collapsed. The resulting depressions and holes would limit land use for livestock grazing. A further problem might be underground coal fires, which can start where unmined coal is exposed to air. Such fires have burned for years, despite repeated efforts to extinguish them. Underground mining also recovers considerably less coal than strip mining: the most efficient techniques recover about 80 percent, compared to over 94 percent Western Energy expects to recover.

Auger mining could be used in conjunction with strip mining to recover additional coal in highwalls and along outcrops. In highwalls, for example, the auger could bore into the coal seams beyond the economic limit of overburden removal for coal stripping. Auger mining, in this case, would not replace strip mining, but would be used as a minor supplement to the strip-mining methods already proposed.

Auger mining, like underground mining, has two drawbacks. The holes left by the auger would be costly and difficult to seal. In addition, the company would recover less than 50 percent of the coal, leaving the remaining coal unrecoverable by conventional techniques.

WESTERN ENERGY COMPANY'S PROPOSAL

Area D lies one mile northeast of Colstrip, Montana. It is one of five mining units in the Rosebud Mine (fig. I-1) and is the only unit that has not been mined by Western Energy in the past. Some nearby lands were mined by the Northern Pacific from 1925 to 1948. Mining in Area D would probably begin in 1985, when the coal in Area E is depleted.

Western Energy has two plans for Area D. The first is the application plan, submitted by the company to obtain a permit to mine. This plan covers 3,073 acres in section 13, 14, 15, 22, 23, 24, 25, 26, 27, and 35 of T2N, R41E (fig. I-2). In this plan the company would disturb 2,615 acres over 18 years: 1,708 acres would be mined and another 907 acres would be disturbed for road building, stockpiles, facilities, and similar uses. Of the entire 3,073-acre area, 2,457 acres would be bonded for mining-level disturbance, 48 acres for facilities-level disturbance, and 568 acres for associated disturbance.

The second plan would extend the application area both east and west. The eastern extension would lie within sections 19, 29, and 30 of T2N, R42E, the western extension within sections 22 and 27 of T2N, R41E (fig. I-2). The extensions together total 1,309 acres, of which 850 acres would be disturbed. The eastern extension is not included in the application plan because of legal questions surrounding surface owner consent and because data on soils, overburden, hydrology, and other environmental resources are still being collected. The western extension was not included because Western Energy must first obtain permission to mine within 1,000 feet of the Colstrip Townsite Expansion Subdivision boundary. Western Energy expects to formally submit plans for the entire Area D unit as soon as the company has the permission to mine and the necessary data.

By extending the application area both east and west, Western Energy would create a mining unit totalling 4,382 acres. In the total area, 3,465 acres would be disturbed--2,161 acres by mining and another 1,304 acres by related activities. The entire Area D operation would last 23 years.

COAL RESERVES

Two of Area D's coal seams, the Rosebud and the McKay, are mineable by today's surface-mining technology. Western Energy, however, would mine only the Rosebud seam, the upper of the two. The 8-foot McKay seam, lying an average of 23 feet below the Rosebud, is of poorer quality, containing more sulfur, iron, and sodium than the Rosebud seam (table I-1). The iron causes slagging at normal boiler operating temperatures; the sodium increases the likelihood of boiler tube deterioration. Because of the lower quality of the McKay coal, on June 4, 1979, the Montana Board of Natural Resources and Conservation prohibited the use of McKay coal either as an exclusive fuel or in combination with the Rosebud coal in Colstrip Generating Units 3 and 4. Western Energy has not

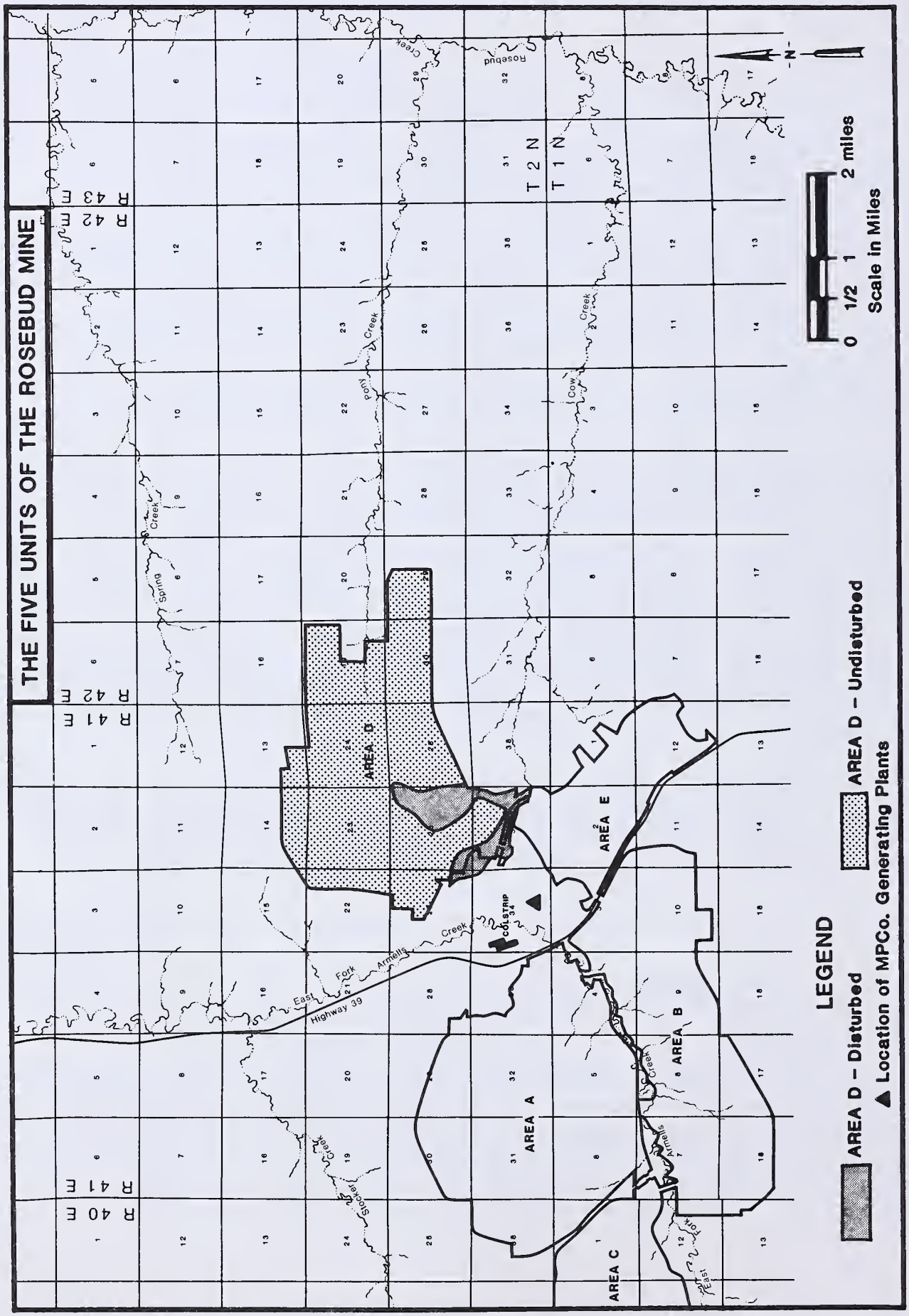


FIGURE I-1

The Rosebud Mine has five units, Areas A, B, C, D, and E. All units have been or are now being mined by Western Energy Company, except Area D. Area D would open when Area E closes.

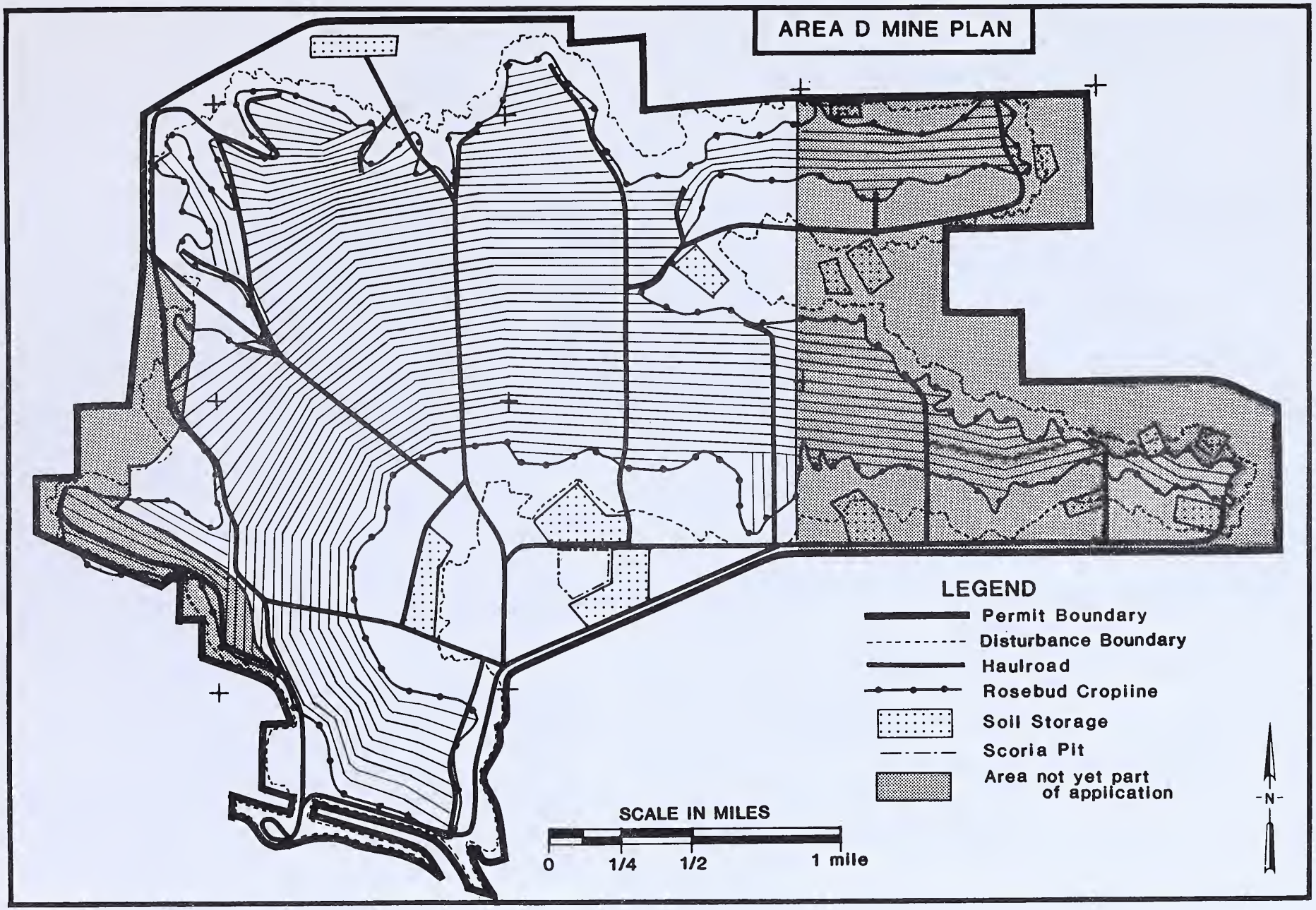


FIGURE I-2

For planning purposes, Area D has two parts: the application area (unshaded) and the life-of-mine expansion (shaded). To date, Western Energy has applied for a permit to mine only the application area, although the company eventually plans to amend its application to include the entire area shown.

TABLE I-1

Coal Quality as Received

Measure	Coal Seam	
	Rosebud	McKay
BTU per pound	8,474	8,460
Percent moisture	26.34	27.46
Percent ash	8.9	7.48
Percent sulfur	0.78	1.40

Source: Western Energy, 1984, vol. 4, app. F; Charles Rose, Western Energy Company, pers. comm., May 17, 1984.
Note: Figures are approximate weighted averages.

found a market for the McKay coal and does not plan to mine the seam, although the nearby Big Sky Mine does mine and market a blend of the McKay and Rosebud coal.

The Rosebud seam within the application area contains 68.5 million tons of economically recoverable coal. Western Energy would mine these reserves over 18 years at an annual average rate of 3.8 million tons per year (table I-2). The life-of-mine expansion contains 19.3 million tons of recoverable coal, which would be mined over 5 more years at the same average annual rate of 3.8 million tons per year (table I-2). About 6 percent of the reserves in either plan would be lost to waste, spillage, and limits on coal-extraction technology.

TABLE I-2

Area D Coal Production and Land Disturbance

Year	Application Area (18 years)		Total Area (23 years)	
	Coal Production (millions of tons)	Disturbance (acres)	Coal Production (millions of tons)	Disturbance (acres)
1985	2.0	74	2.0	77
1986-2001	4.0 (yearly)	153 (yearly)	4.0 (yearly)	158 (yearly)
2002	2.5	93	4.0	158
2003-2006	-0-	-0-	4.0 (yearly)	158 (yearly)
2007	-0-	-0-	1.8	78
TOTAL	68.5	2,615	87.8	3,465

Source: Charles Rose, Western Energy Company, pers. comm., May 17, 1984.
Note: Acreage differences between the application area and total area for 1985-2001 result from averaging.

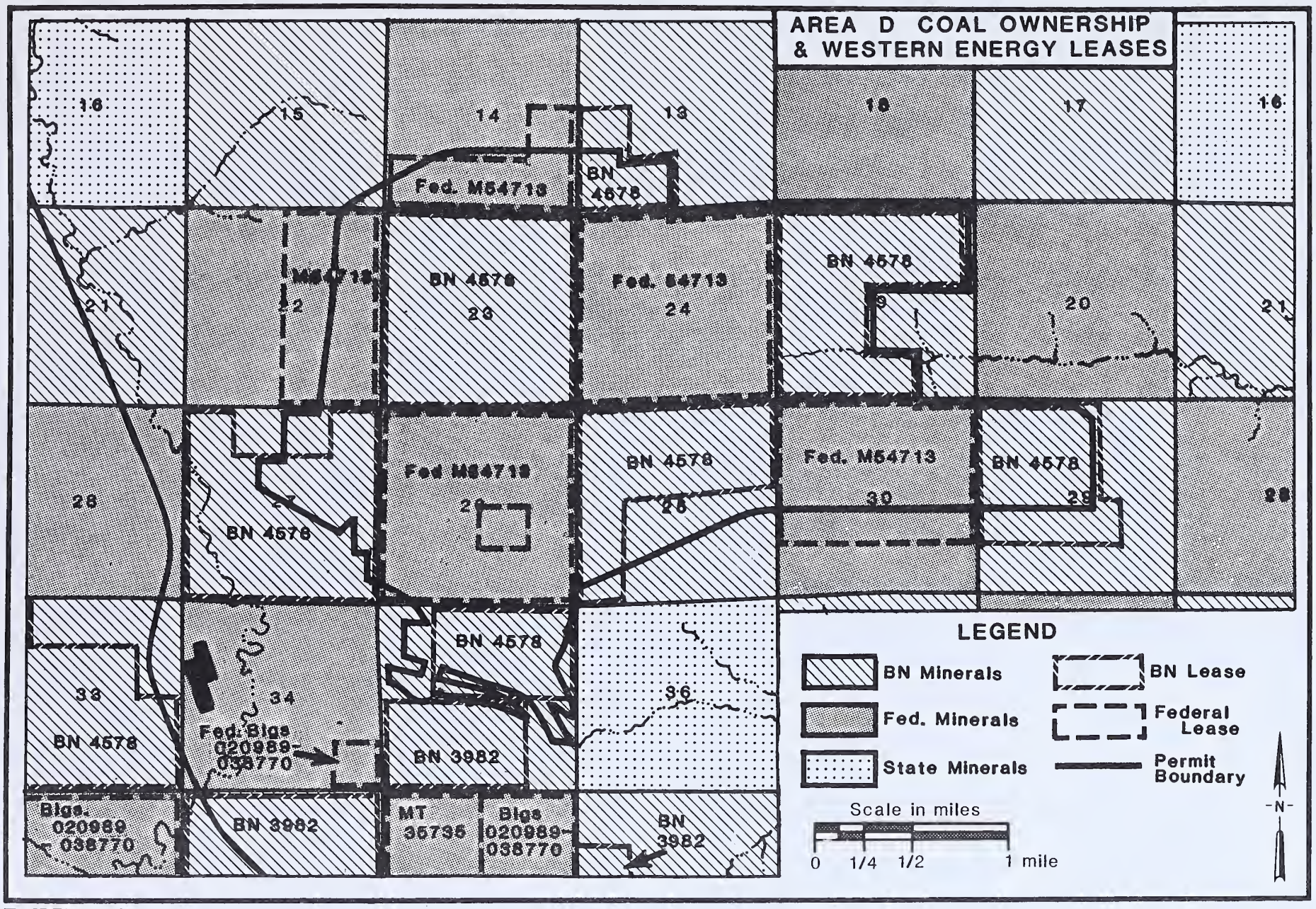


FIGURE I-3

Western Energy has leased all coal proposed for mining in Area D. The coal is owned by both the federal government and Burlington Northern Inc.

Western Energy proposes to ship part of the coal from Area D to the Corette Generating Plant in Billings, part to Colstrip Generating Units 1 and 2, and the rest to short-term "odd-lot" customers.

The company would lease all Area D coal from Burlington Northern Inc. and the federal government (fig. I-3). Of the 4,382 acres of surface in Area D, the company would lease about half from Burlington Northern Inc. The remainder is owned by Western Energy, Sunlight Development Company, and a privately owned ranch called Genie Land and Livestock Company (fig. I-4). Not all coal and surface leases have been acquired, but Western Energy plans to have negotiated all leases for the Area D application area by the time of the permit decision.

In the life-of-mine expansion, the surface owned by the private ranch is now the subject of a law suit. Section 82-4-224 of the Montana Strip and Underground Mine Reclamation Act provides that, where the mineral and surface estates of state or private land are split, the applicant for a permit to strip mine must include in his application the surface owner's waiver or consent to allow the applicant to strip mine. If the application does not contain this documentation, the Department of State Lands cannot issue a permit. The owner of the private ranch property has refused to grant a waiver or consent. Western Energy Company has filed suit in Rosebud County against the landowner and the Department of State Lands. Western Energy contends that the landowner's predecessor in interest granted a waiver by accepting a deed to the surface estate only. As an alternative, the company contends that the statute requiring surface owner consent is unconstitutional.

MINING PLAN

Facilities

Western Energy would haul coal to the southern end of Area D, into Area E, and dump the coal at the Area E facilities. No new facilities would be built, except for a 200-foot-long haul road overpass across the Burlington Northern railroad. The coal would be loaded at the Area E siding onto unit trains or routed along a conveyor to Colstrip Units 1 and 2.

Facilities now used for Area E that would continue in use include the following (fig I-5): the railroad siding for loading unit trains, several steel-framed structures, a maintenance shop, change rooms, bath facilities, fuel tanks, the truck dump, the primary and secondary crusher, the coal stockpile, and the train-loading station.

Mining Method

Western Energy proposes to strip mine Area D with a dragline, first digging a long boxcut (the first cut of the mine) alongside the Rosebud cropline or the last pit excavated by the Northern Pacific Railroad. Mining would advance west and north in a semicircular pattern, as the dragline digs successive strips one beside the other (fig. I-2).

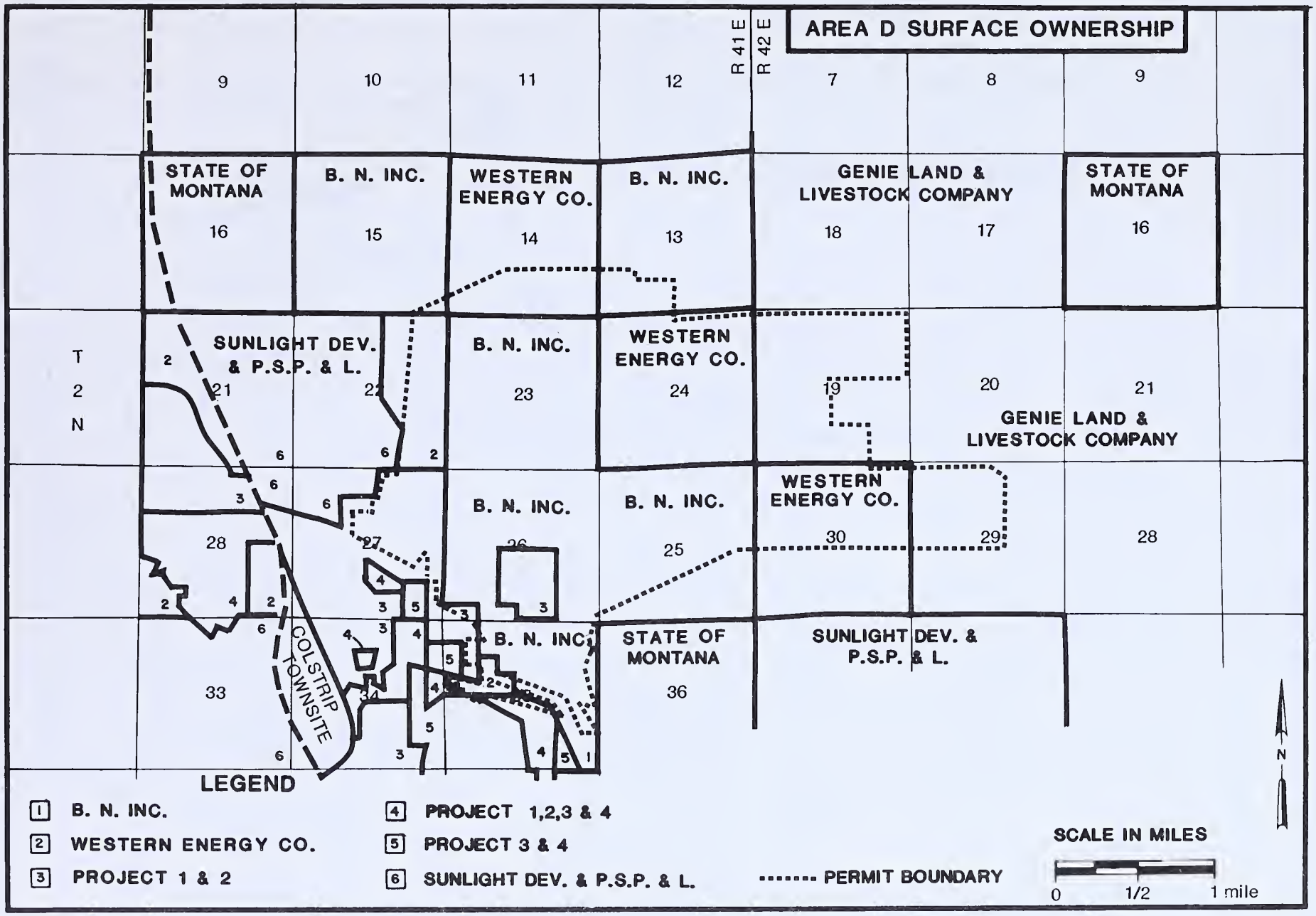


FIGURE I-4

Western Energy would lease about half the surface from Burlington Northern Inc. The remainder is owned by Western Energy and Sunlight Development Company (Montana Power Company subsidiaries) and Genie Land and Livestock Company, a private ranch.

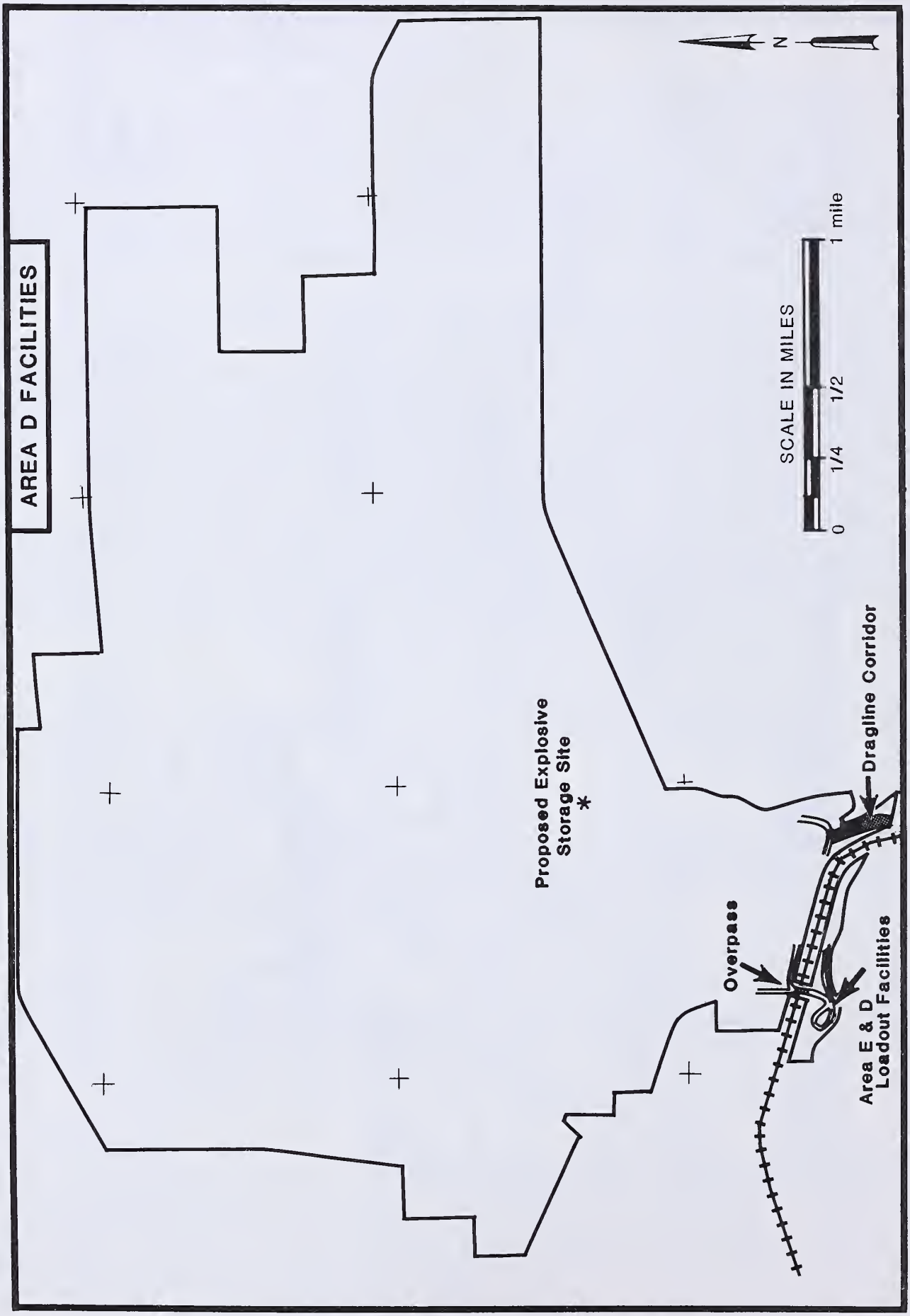


FIGURE I-5

Western Energy would use the Area E facilities for Area D. The only change to accommodate Area D would be the construction of an overpass across the Burlington Northern main line.

Before any overburden excavation, scrapers would strip the soil, first taking 6 to 8 inches of topsoil and then approximately 2 feet of subsoil. Drills would then bore into the overburden, the drill holes would be filled with explosives, and the overburden would be blasted. The dragline and sometimes scrapers would strip the broken overburden down to the Rosebud seam.

After cleaning the Rosebud coal surface, the company would drill and blast the Rosebud coal. Seventeen-cubic-yard shovels would load the coal into 120-ton coal trucks. The trucks would haul the coal to the Area E facilities, where the coal would be crushed before stockpiling or loading onto trains.

During boxcut excavation, scrapers would place topsoil and subsoil in segregated storage piles. During succeeding dragline passes, the scrapers would immediately respread the soil on mined-out lands that had been covered with overburden and regraded. Because of the uneven shape of the mining area, Western Energy would again have to stockpile some soil in the northern and eastern parts of the mine area. The company would seed all soil stockpiles to prevent erosion losses.

Overburden taken from the initial cut would be cast both into the existing pit and onto spoil piles left by the Northern Pacific. During the second and later cuts, the dragline would cast spoil (excavated overburden) into the pit left from the preceding mined-out cut.

Department of State Lands regulations require that during mining all surface water from spoil piles, soil piles, and disturbed drainages be passed through sediment ponds before leaving the permit area. The ponds would allow suspended sediment to settle out of the water. All such ponds would be designed to safely retain runoff created by a 10-year 24-hour precipitation event (the largest rainstorm or snowmelt in one 24-hour period likely to occur once every ten years). The sediment ponds would also retain water pumped from the pit. Berms, ditches, and small sediment traps would intercept the runoff from haul roads and soil stockpiles.

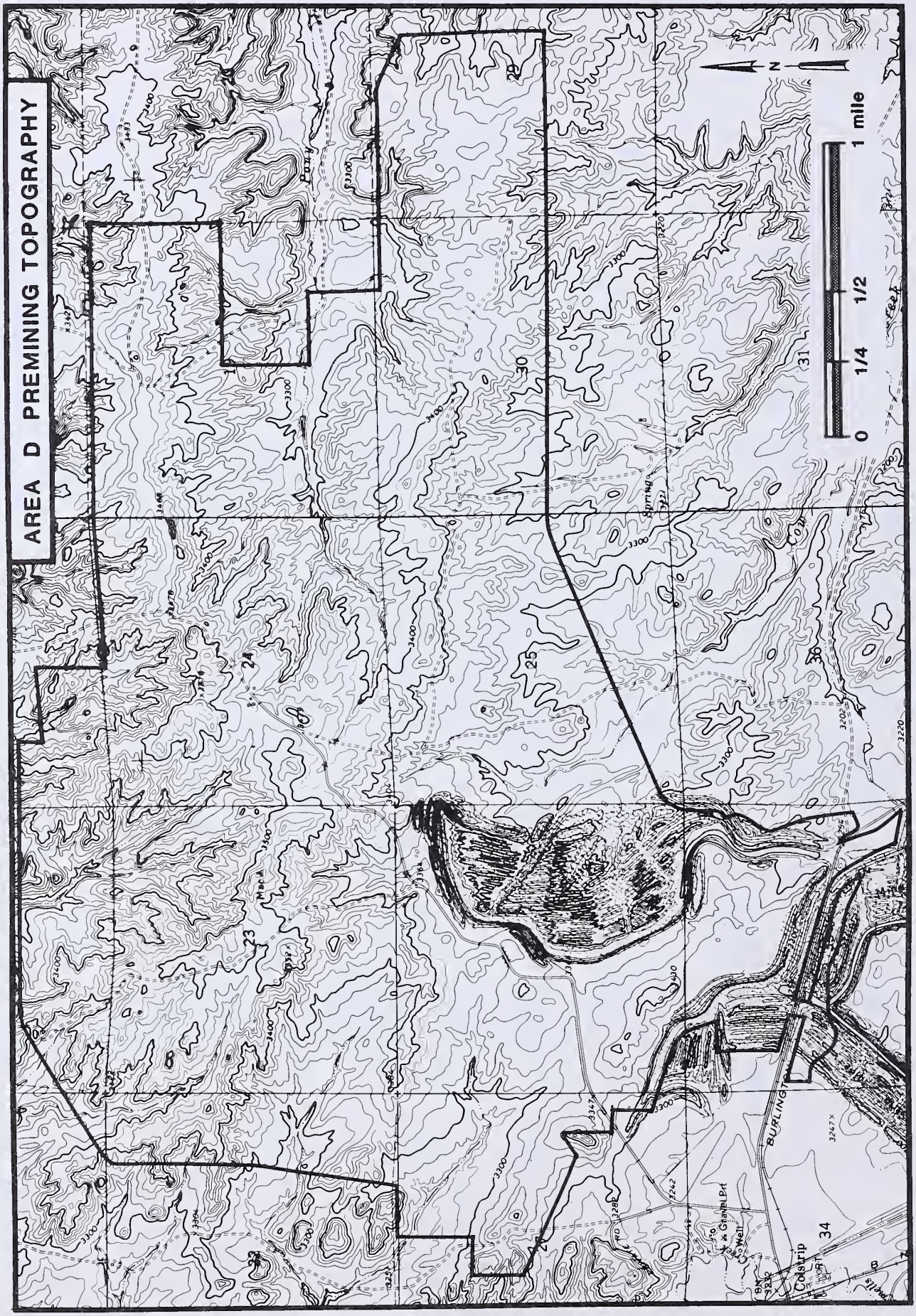
General mine safety would be regulated by the U.S. Mine Safety and Health Administration and the Montana Department of Labor. The Department of State Lands would regulate coal and overburden blasting.

Employment at the Mine

Employment at the Rosebud Mine today totals about 330. This figure is projected to rise to about 500 by 1985 if coal markets improve. The number of employees working in Area D alone would range from 77 in 1985 to a maximum of 150 in 1997 through 2006.

RECLAMATION PLAN

Once the dragline has cast spoil into the mined-out pit, dozers and scrapers would reshape the spoil to resemble the premining landscape (figs. I-6 and I-7). Nearly all slopes would be graded to less than 20 percent. All slopes


AREA D PREMINING TOPOGRAPHY
N
0
1/4
1/2
1 mile
Colstrip
BURLINGTON
Spring
Mesa
Coal
Gravel Pit
Well
BM
3220
3247
3300
3400
3500
3200
3242
3267
3391
3342
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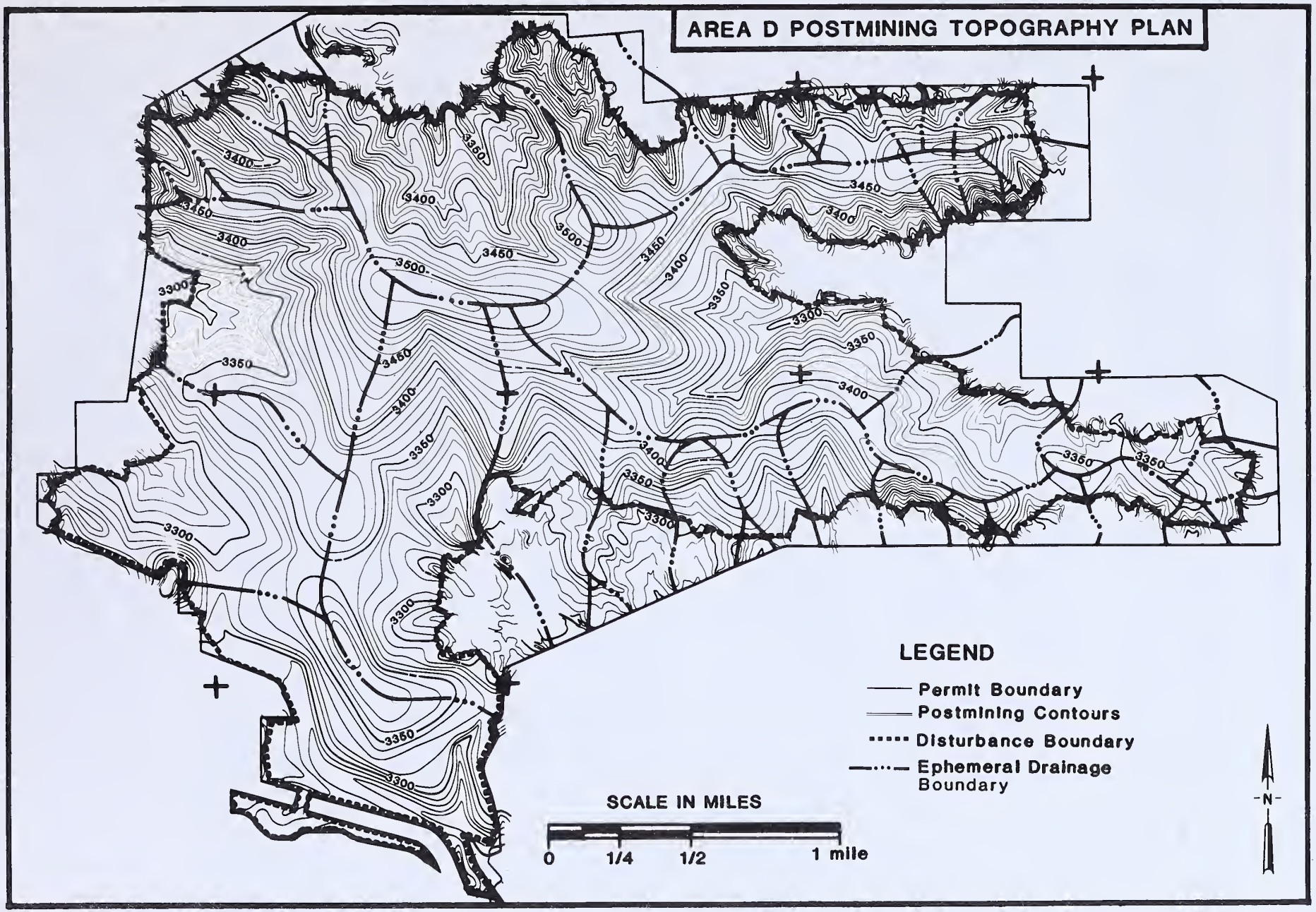

FIGURE I-7

After mining, Western Energy would regrade the landscape to restore the approximate premining topography. (Compare with figure I-6.) Included in the company's plan are the locations of the postmining watersheds.

would be given a complex (convex upper-concave lower) profile, a configuration that minimizes sheet and rill erosion. Any spoil that would hinder plant growth would be buried under 8 feet of nontoxic overburden.

During spoil regrading, Western Energy would also rebuild the premining drainages. Drainage-bottom profiles would have a smooth concave profile, without nick points (irregularities in the profile where gully erosion can begin). Premining channel and flood-plain dimensions would be reestablished, and channels would be restored to their natural meandering pattern and flood-plain gradients.

Along the outer edge of the mine area, a "highwall," or steep cut rising from the base of the Rosebud seam to the undisturbed surface, would sometimes be present. The company would fill the final pit with spoil and reshape the highwall. Dozers and scrapers would contour the area into complex slopes no steeper than 20 percent, smoothly blending the slopes and drainages of the mined lands into the topography of the unmined lands. Since Western Energy would mine Area D outcrop to outcrop, many areas would not require highwall reduction.

Following spoil grading, Western Energy would rip the top 6 to 10 inches of the spoil surface. Scrapers would spread 1 to 2 feet of subsoil and 6 to 8 inches of topsoil. To minimize erosion, sandy-textured soils would not be put in drainages or on slopes steeper than 10 percent. The stockpiled soil would be used for the last areas to be reclaimed and the lands regraded during final highwall grading.

To prepare the seedbed, Western Energy would fertilize, rip, chisel plow, and disc the topsoil to roughen the surface. Forbs, shrubs, and warm-season grass species would be broadcast seeded. One to three seasons later, the company would seed again, this time with more aggressive cool-season grasses. The delay in the second seeding would keep the cool-season species from initially suppressing the less-aggressive forbs, shrubs, and warm-season grasses. In addition to seeding, the company would plant some shrub and tree species as tubelings.

To control erosion, parts of some drainage bottoms may be sodded and slopes over 10 percent would be mulched. The mulch would also promote seed germination and help hold soil moisture.

The amount of acreage reclaimed each year would approximate the amount disturbed. The company would replace about the same number of acres of ponderosa pine forest as it removes during mining. Reclamation would return the mined lands for use by grazing livestock and wildlife. Western Energy would manage the land mainly with a deferred-rotation grazing system, started after the third growing season.

Monitoring the Postmining Landscape

Western Energy would monitor the postmining landscape for erosion, vegetative productivity, plant density, plant diversity, ground cover, and soil nutrient levels. Rills and gullies deeper than 9 inches would be tilled, and the surface would be respread with topsoil and reseeded.

Wildlife would also be monitored. Western Energy would estimate populations of big game, upland birds, raptors, songbirds, and small mammals by aerial surveys, nest counts, trapping, and other methods.

Throughout the mine's life, the company would monitor ground water in a number of wells around the mine. Surface water runoff would be monitored in one small ephemeral tributary to the East Fork Armells Creek, and in the headwaters of Spring Creek, Cow Creek, and Pony Creek. The company must sample the water and give test results quarterly to both the Department of Health and Environmental Sciences and the Department of State Lands. The company would also sample any surface water discharge from sediment ponds. Before bond release, surface waters must meet permit requirements (MPDES) established by the Department of Health and Environmental Sciences.

Postmining surface water quality would be protected initially by a network of sediment ponds and runoff collecting ditches (including some of the ponds and ditches that collected runoff during mining). The company must monitor and maintain these sediment-control structures until the Department of State Lands determines that the land has been successfully reclaimed. The Department would then release the company's reclamation bond and the company would remove the sediment ditches and most ponds. Three ponds would be left in the Area D application area for stock watering.

Chapter II

DESCRIPTION OF THE EXISTING ENVIRONMENT

The analysis of Western Energy's plans in this EIS covers a number of subjects, representing the "environment" of Area D today. This environment encompasses the resources, enterprises, services, facilities, and people that could be affected by the project.

GEOLOGY

Topography and Geomorphology

The topography and geomorphology of Area D are typical of uplands in southeastern Montana. Area D consists of bedrock ridges and breaks of low to moderate relief that are dissected by small ephemeral drainages. Elevations range between 3,250 and 3,570 feet and slopes are generally moderate with occasional rock outcrops and steep clinker and sandstone bluffs. The steepest slopes are located in the northern portion of the application area. Part of Area D in the Cow Creek drainage (sections 26 and 27, T2N, R41E) was previously mined but not reclaimed. The topography in this unreclaimed area includes irregular spoil piles and an abandoned pit and highwall.

Area D is drained by ephemeral channels that flow into East Fork Armells Creek to the west, Spring Creek to the north, Pony Creek to the east, and Cow Creek to the south. Ephemeral drainages within Area D are generally shorter than one mile. They have well defined channels in the steeper upper reaches and poorly defined channels in the more moderately sloped reaches which occupy much of Area D. In many reaches, broad, flat, well-vegetated valley bottoms contain no visible stream channel. A few drainages contain discontinuous gullies, but most reaches appear stable.

Erosion rate calculations for the Rosebud Mine (Montana Department of State Lands [MDSL] and Office of Surface Mining [OSM], 1983, pp. 2-43) indicate relatively low sediment yields. Severe erosion has not been identified within Area D. In the unreclaimed Northern Pacific spoil, erosion is probably severe but is limited in extent by internal drainage.

Structure and Stratigraphy

Within Area D, the shallow bedrock strata dip gently (1 to 2 percent) to the south-southeast. The area is underlain by the Tongue River Member of the Fort Union Formation (fig. II-1). The Tongue River Member includes deposits of sandstone, siltstone, shale, coal (fig. II-2) and clinker (bedrock strata altered by the natural burning of coal beds along coal seam outcrops). The Rosebud coal in Area D averages about 25 feet in thickness and is overlain by an average of about 100 feet of overburden (bedrock). Underlying the Rosebud

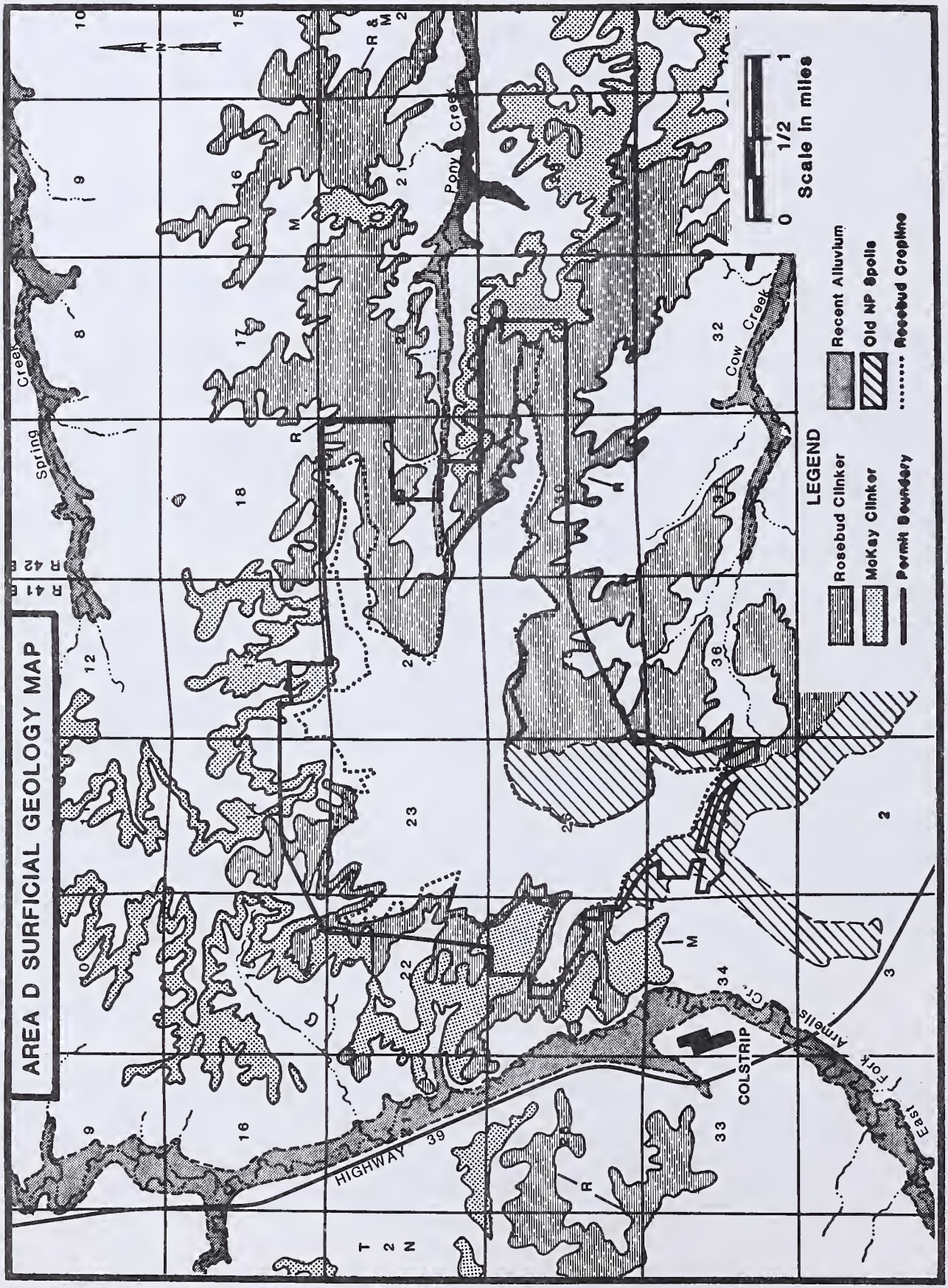

FIGURE II-1

The surface deposits of importance to Area D's ground water include clinker, alluvium, and old spoil. Very little alluvium lies within Area D.

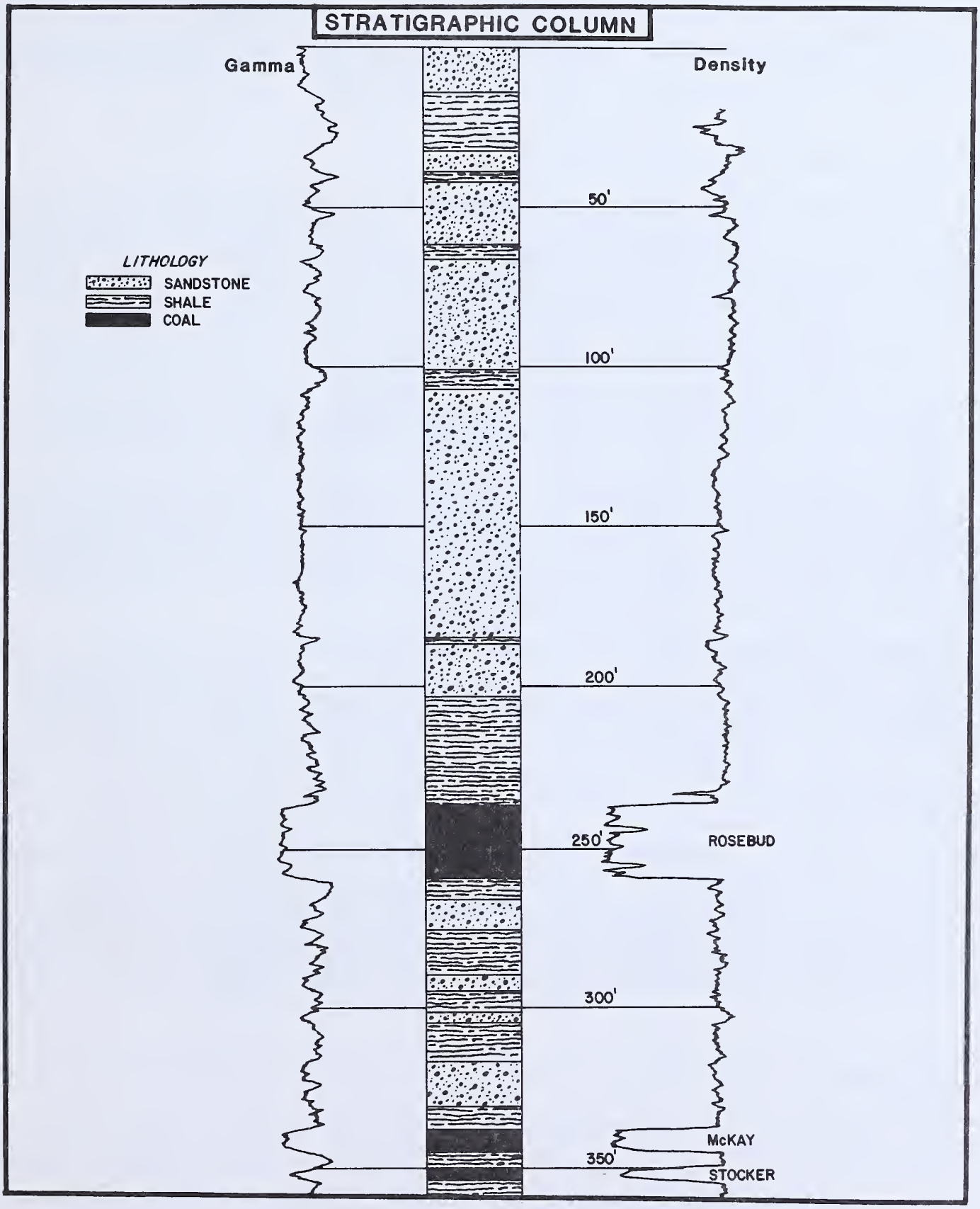

FIGURE II-2

The stratigraphy of Area D is relatively uniform, made up of the Tongue River member of the Fort Union Formation. Western Energy would mine only the Rosebud coal. The McKay coal is of lower quality.

coal and separated by an average of 28 feet of bedrock, is the eight-foot-thick McKay coal seam. Minor Quaternary deposits, consisting of slope-wash deposits (colluvium) and stream-laid deposits (alluvium), occur primarily along the stream drainages.

Overburden

Western Energy Company has sampled and analyzed overburden throughout Area D. Samples were obtained from five-foot depth intervals from drill holes located generally on a thousand-foot grid system. Results of the analyses show that most of the overburden material is suitable for plant growth, according to the draft 1983 Department of State Lands soil and overburden guidelines.

Most samples which do not meet some particular criteria are scattered and are not considered indicative of predominant trends. An exception to this is the coarse-textured sandy material found in significant portions at numerous locations. One drill hole had elevated salinity levels throughout its profile.

Only two overburden sampling locations had unsuitable trace element concentrations. At one of these locations, the ten feet of material overlying the Rosebud coal were high in molybdenum. The other location contained several samples high in boron. The material high in boron is the same material with elevated salinity levels mentioned above.

The overburden sampling shows that the Area D overburden materials fall within suitable ranges for all other suitability criteria with only inconsequential exceptions. In general, good-quality overburden material is abundant in Area D.

Geologic Hazards

No known geologic features (active faults, landslides, etc.) endanger human life or property within the Colstrip region. The southeastern quarter of Montana has experienced few earthquakes in the last century (Witkind, 1975). The strongest ground shaking recorded for eastern Montana (from the Hebgen Lake earthquake in 1959) registered V on the modified Mercalli scale and did not structurally damage buildings (Qamar and Breuninger, 1979).

HYDROLOGY

Ground Water

Ground Water Occurrence

Within the Rosebud Mine area are several shallow water-bearing strata: valley fill materials, Rosebud coal overburden, Rosebud coal, Rosebud-McKay interburden, McKay coal, sub-McKay strata, and Rosebud spoil (replaced overburden).

The quality of ground water varies, depending both on the geology of the water-bearing strata, and, in places, on the impacts of mining and other man-made activities. The major ground water source is the sub-McKay strata, used mostly for livestock watering (fig. II-3).

Valley Fill Materials

Valley fill materials include unconsolidated colluvial and alluvial deposits of clay, silt, sand, and gravel. The small ephemeral drainages in Area D contain little valley fill. Larger deposits of alluvium lie downstream of Area D, along Spring Creek, Cow Creek, Pony Creek, and East Fork Armells Creek. Within Area D, valley fill becomes saturated only briefly during spring snowmelt or following heavy runoff. Limited areas of saturated valley fill may occur where overburden or coal springs and seeps discharge within drainages.

Downstream of Area D, significant amounts of alluvial ground water occur in the Cow Creek and East Fork Armells Creek drainages and, to a lesser extent, in the Spring Creek and Pony Creek drainages. Available data indicate a range in transmissivities of 6 to 74,800 gallons per day per foot (gpd/ft) for East Fork Armells Creek alluvium and 190 to 49,500 gpd/ft in Cow Creek alluvium (Montana Department of State Lands [MDSL] and U.S. Office of Surface Mining [OSM], 1983a, table 2.2-1). In general, transmissivities increase downstream.

Rosebud Coal Overburden

The Rosebud coal overburden consists of interbedded sandstone, siltstone and shale strata. Clinker deposits occur both within and adjacent to Area D. Ground water occurrence within the overburden varies throughout Area D and is most often found in discontinuous fine-grained sand and silty-sand lenses. In the eastern portion of Area D, the overburden appears to be dry. Data on the occurrence of ground water in clinker at the Rosebud Mine are limited. One well, apparently completed in clinker in Area D, was dry.

Transmissivity measured at one well completed in overburden in Area D was very low, 11 gpd/ft. Transmissivity data for Rosebud overburden in other areas at the Rosebud Mine range widely, from 1 to 79,000 gpd/ft (MDSL and OSM, 1983a). However, excluding data from one section of Area B, overburden transmissivities are generally less than a few hundred gpd/ft.

Rosebud Coal

The Rosebud coal is dry or only partially saturated in Area D. The dry portions lie along the area's northern edge and the narrow eastern ridges. Coal saturation increases to the south toward Cow Creek, but the aquifer remains unconfined throughout Area D. Calculated transmissivities for two Rosebud coal wells in the application area are 9.8 and 30 gpd/ft. These values are low for the Rosebud Mine area and probably represent the partial saturation of the Rosebud coal within Area D. The lognormal mean transmissivity of the Rosebud coal is 32 gpd/ft in the Colstrip area.

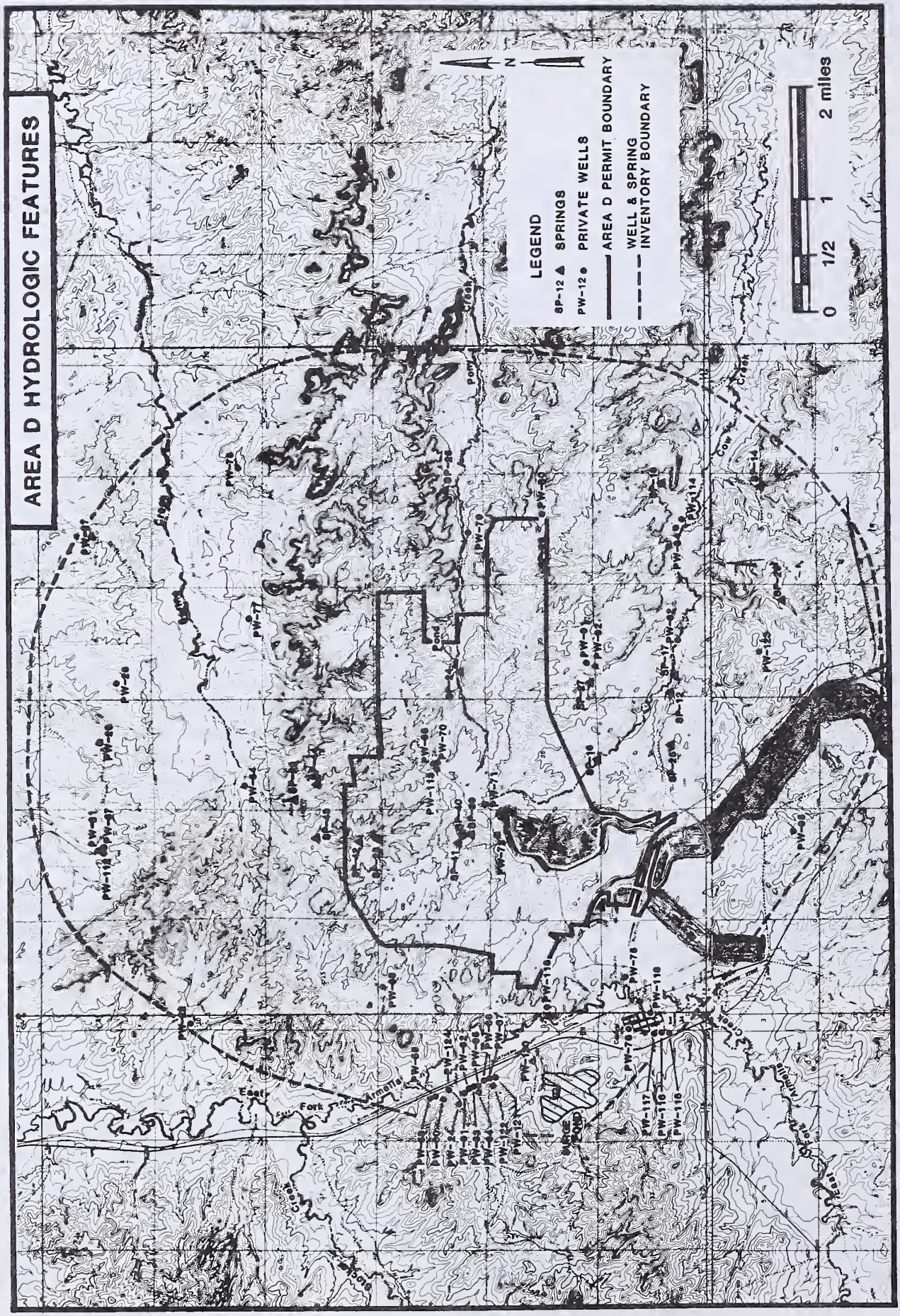

FIGURE II-3

Three springs and five wells lie within the part of Area D that Western Energy would mine. The springs are fed by, and the wells are completed in, the Rosebud overburden. Most of the water is consumed by livestock.

Rosebud-McKay Interburden

The Rosebud-McKay interburden (the bedrock between the coal seams) consists of interbedded clay, shale, and sandstone lenses, and varies in thickness from about 10 to 50 feet within Area D. The interburden is saturated or partially saturated within most of Area D, but appears dry along the ridges to the east. Transmissivity values for the interburden are generally very low in the Rosebud Mine area (MDSL and OSM, 1983a, p. 217) and it is not considered a productive water-bearing stratum.

McKay Coal

Water in the McKay coal usually occurs under confined conditions in the Rosebud Mine area. Transmissivity values are low: Average reported values range from 10 to 138 gpd/ft.

Sub-McKay

The regional sub-McKay aquifer consists of sandstone and sandy clays, and is underlain by the nearly impermeable Lebo Shale. The sub-McKay is considered a confined aquifer with transmissivity values ranging from 90 to 3,200 gpd/ft, and averaging 860 gpd/ft (MDSL and OSM, 1983a). It is the primary ground water source for wells in the Colstrip area.

Rosebud Coal Spoil

Several areas of old Northern Pacific spoil lie within and next to the southwestern part of Area D. Large portions of the old spoil are currently unreclaimed. The spoil contains ground water which has entered through inflow from adjacent coal and overburden or through direct recharge by precipitation. In general, hydraulic conductivity values for spoil are similar to those of the unmined coal and overburden (Van Voast et al., 1978b). Transmissivity values for spoil in the Rosebud area range from 1 to 23,400 gpd/ft with a mean of about 2,000 gpd/ft (MDSL and OSM, 1983a, table 2.2-1). A more permeable rubble zone, consisting of waste coal and large rock fragments that accumulated during spoil replacement, has been noted at the base of the spoil and may be responsible for the large range in transmissivity (Van Voast et al., 1978b, p. 19).

Storage coefficient values for spoil are low (0.00001 to 0.00003). At other mine pits in the area, a saturated zone as much as five meters thick has developed in the mine spoil (Van Voast et al., 1978a, p. 13). In most cases, at Colstrip, this zone is less than one meter thick (Van Voast et al., 1978b, p. 13). Water levels in spoil wells respond to changes in atmospheric pressure, indicating that the flow systems are probably confined within the rubble zone at the base of the spoil.

Ground Water Flow in Area D

Ground water recharge and discharge from the overburden and Rosebud Coal occur locally within or next to Area D as a result of the topographic isolation of

these strata by outcrop and subcrop areas. This relationship exists to a lesser extent for other strata down to the sub-McKay.

Ground water in the overburden probably flows only locally within discontinuous strata. The direction of flow probably more closely reflects topography than does flow within the coal. The overburden recharges directly through the soil and within drainages. Ground water discharges from the overburden at a series of seeps within a drainage near the center of Area D.

Ground water flow in the Rosebud Coal of Area D is generally southward toward Pony and Cow Creeks (fig. II-4). The coal is dry along the northern edge of Area D. Its saturated thickness increases toward the southern subcrop, where the aquifer is almost totally saturated. Portions of the Rosebud coal underlying the eastern ridges within the Area D life-of-mine expansion are also dry. Recharge to the Rosebud seam comes from vertical percolation through the overburden and probably from lateral movement through clinker. The importance of clinker areas as recharge zones is not well understood.

Ground water flow within the McKay coal generally parallels the flow in the Rosebud coal. Discharge occurs through springs and seepage to tributaries of Cow Creek. McKay springs on the north edge of Area D that discharge in tributaries to Spring Creek may represent localized flow influenced by topography. Adjacent McKay and Rosebud clinker, and Rosebud overburden probably recharge these springs.

Ground water flow in the sub-McKay and Rosebud overburden is not well defined in the Rosebud mine area. Based upon limited data, discharge from the sub-McKay probably provides the majority of water to the lower reaches of the Cow Creek alluvial aquifer.

Ground water flow also occurs within old Northern Pacific spoil. The ground water flows in part from adjacent Rosebud coal and overburden. The largest component of flow, however, may be derived from direct recharge to the spoil. The hummocky topography of the unreclaimed spoil traps surface runoff within numerous depressions, allowing significant recharge. Discharge from these and adjacent spoil in Area E and at Pit 6 are believed to contribute water to alluvium in tributary drainages of Cow Creek (MDSL and OSM, 1983b, p. 3-46).

Ground Water Quality

Ground water quality data are available for several wells within or next to Area D. Data from one well completed in the overburden within Area D indicates a calcium and magnesium-bicarbonate type water with an average TDS concentration of 420 mg/l (P. Norbeck, Western Energy Company, pers. comm., August, 1984). This value indicates considerably better water quality than for most overburden wells in the Rosebud Mine area, which average 1,850 mg/l (MDSL and OSM, 1983a, p. 238), and for wells completed in the other aquifers within Area D.

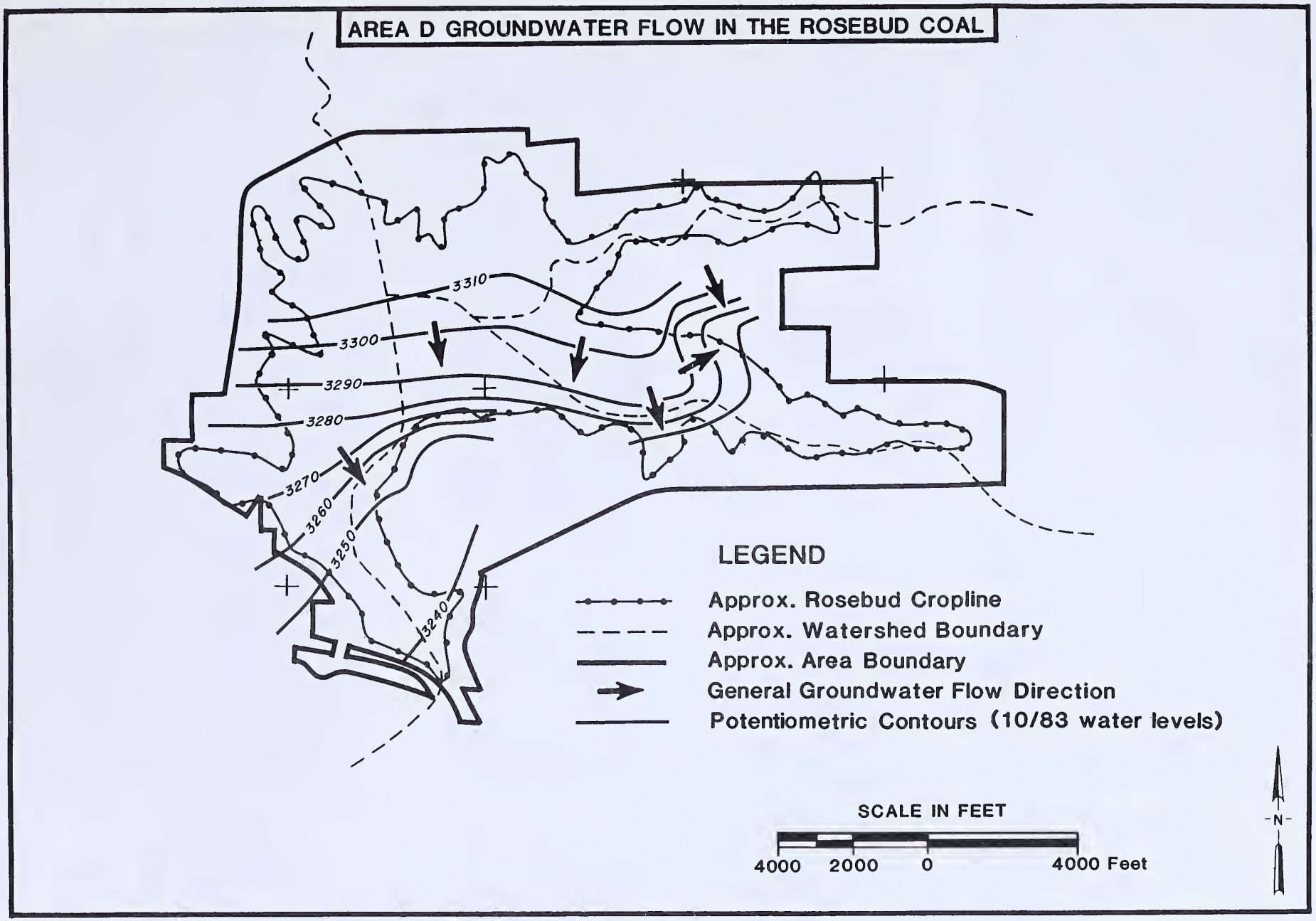

FIGURE II-4

Ground water in the Rosebud coal of Area D generally flows southeast, following the 3 percent dip of the coal bed. At the northern edge of Area D, the coal bed is dry.

Water quality data for the Rosebud coal from four wells within Area D vary significantly: TDS values range from 720 to 4,530 mg/l and average about 1,300 mg/l. The predominant water type is a magnesium and calcium-sulfate type. Area D wells completed in the Rosebud-McKay interburden show water quality of a calcium or sodium-sulfate type with TDS concentrations ranging from 2,200 to 3,400 mg/l. Ground water quality of McKay coal water within Area D varies between magnesium, calcium, and sodium-sulfate types with TDS concentrations ranging between 900 and 5,800 mg/l. Water quality data are available for one sub-McKay well in Area D. The well's sodium-sulfate type water and TDS of 2,210 mg/l are similar to water in other sub-McKay wells in the Colstrip area.

Water quality data for spoil in the Rosebud Mine area show TDS levels ranging from 1,100 mg/l to 6,700 mg/l and averaging about 3,300 mg/l. Generally, the higher concentrations are found in the oldest mine spoil (Van Voast et al., 1977, p. 29).

Water quality in valley fill (alluvial) aquifers in the Rosebud Mine also varies. Alluvial water in the upper reaches of Cow Creek normally has TDS concentrations in the range of 4,500 mg/l. This is higher than for similar headwater drainages in the Colstrip area and may reflect degradation in water quality by old Northern Pacific spoil near Areas D and E. Downstream in Cow Creek, TDS concentrations decrease to about 2,700 mg/l, probably as a result of discharge from the sub-McKay aquifer.

Ground Water Use

Ground water is used in the Colstrip area primarily for livestock watering. Domestic municipal, industrial, and irrigation uses consume only minor amounts of ground water. Most area wells (fig. II-3) are completed within the sub-McKay aquifer. A few wells are completed in alluvium, overburden, coal, and deeper water-bearing strata. Four overburden wells have been identified in the application area. One well is used for domestic water (1-2 gpm) and another for livestock (2-3 gpm). The other two overburden wells are abandoned. Another unused well in the mine area is completed in the sub-McKay.

Surface Water

Area D is drained by ephemeral tributaries of Spring Creek, Pony Creek, Cow Creek, and East Fork Armells Creek (fig. I-1). The Area D application area constitutes approximately 5 percent of the total drainage areas of Spring, Pony, and Cow Creeks and about 2 percent of the drainage area of East Fork Armells Creek above the USGS station north of Colstrip. The life-of-mine expansion includes additional area within the Spring, Pony, and Cow Creek drainages.

Ephemeral drainages in Area D carry runoff infrequently. Water flows only as a result of intense precipitation or rapid snowmelt. Bedrock discharges are insignificant contributors to surface flows in the headwaters area.

Stream flow in East Fork Armells Creek is slightly influenced by municipal and industrial discharges and seepage. A detailed discussion of these influences may be found in the Rosebud Mine Comprehensive Study (MDSL and OSM, 1983a), which is incorporated by reference in this EIS.

No water quality data are available for ephemeral drainages within Area D. Data for the Colstrip area indicate that the water quality of runoff in ephemeral drainages is generally of a calcium-bicarbonate type and TDS concentrations are generally less than 1,000 mg/l and often less than 100 mg/l (Western Energy Company [WECO] 1983, p. 11). Data for East Fork Armells Creek, which flows most of the year, shows TDS concentrations for most of the year are greater than 2,000 mg/l and often in the 3,000- to 4,500-mg/l range. Data available for lower Cow Creek are similar, although concentrations are higher during late summer. These high TDS concentrations result from contributions from alluvial water and the concentrating effects of evapotranspiration.

Eighteen springs and seeps have been identified in the vicinity of Area D (fig. II-3). Three of the seeps (Nos. 39, 40, and 41) are located in overburden within the proposed mine pit. The remainder are located in adjacent areas north, east, and south of the proposed mine pit. No springs have been identified west of Area D. Flows are generally low (less than 5 gpm) and disappear near the source. Most springs are fed by alluvial, McKay coal, and sub-McKay aquifers. Three of the springs are fed by the Rosebud overburden, and two springs (Nos. 24 and 26) are fed by the Rosebud coal. Several springs outside the application area (Nos. 22, 23, 24, 41, and 42) have been developed for livestock use and are probably also used by wildlife.

Several stock ponds lie downstream of the area on ephemeral drainages but are generally associated with springs or seeps. This association suggests the ponds are maintained by ground water inflows. One pond, located adjacent to the mine area on Pony Creek, is fed by a perennial spring (No. 24) and seep area probably discharging from the Rosebud coal seam. Another perennial pond fed by McKay ground water (spring 23), located adjacent to Area D, is used by livestock and wildlife. Downstream of Area D, Cow Creek and East Fork Armells Creek runoff are used for flood irrigation. (No alluvial valley floors have been delineated within Area D.)

SOILS

Area D is primarily covered by soils with thin, dark-colored surface layers and light-colored subsoils. Other, less prevalent soils in the area include those with little or no development and those with thick and dark surface layers. Bedrock outcrops are found on the upper side slopes of the ridges in the northern, central, and eastern portions of the area. Mine spoil covers the south-central portion of Area D.

Thirteen soil series occurring in 21 map units lie within the area to be disturbed. Based on similarities in texture, parent materials, topographic position, and previous land use, these soils (fig. II-5) can be placed into four major groups:

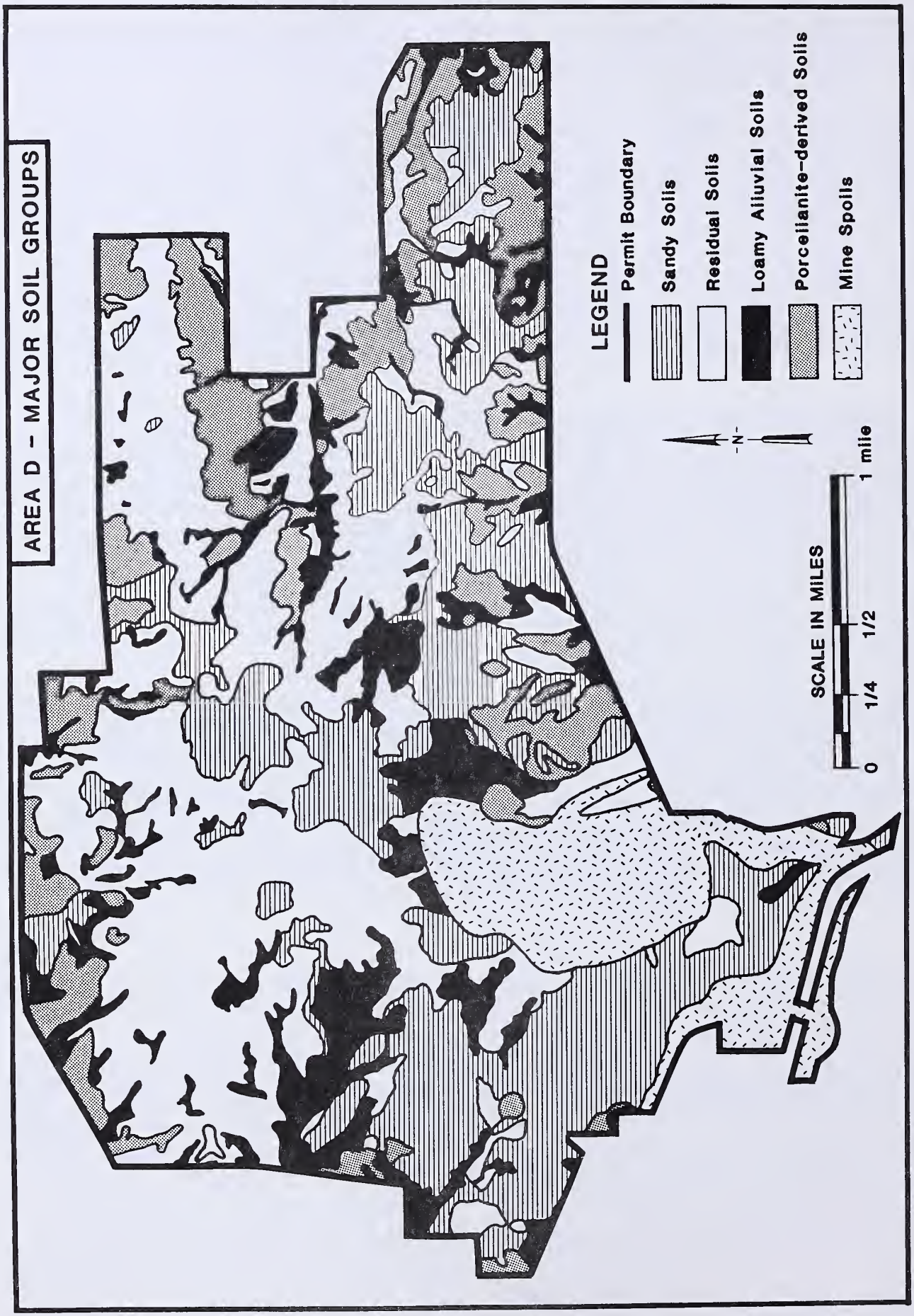

FIGURE II-5

Four major soils groups lie in the 4,382 acres of Area D. Residual soils are the most common.

- sandy soils
- loamy alluvial soils
- residual soils
- porcellanite-derived soils

The relationship between the major soils, geology and their landscape position in the Colstrip area is shown in fig. II-6.

Sandy Soils

Soils in this group formed in coarse-textured alluvial, residual, and wind-deposited materials. These soils are found on gently rolling uplands and alluvial fans, and along narrow drainages, and make up 25 percent of the total Area D disturbance area. The dominant soil series in the group is Busby with lesser amounts of Reidel, Spang, Yetull, and minor inclusions. Rock outcrops occur in some map units in this group.

Surface and subsurface textures range from loamy sands to sandy loams. Near rock outcrops and on ridge crests, soils are generally less than 40 inches deep. Elsewhere, they are usually deeper than 60 inches. Because of the coarse textures, available water capacity is low to moderate and permeability is moderately rapid to rapid.

Grassland, dominated by needle-and-thread, western wheatgrass, and blue grama, is the dominant vegetation community found on these soils. In some places, these soils are vegetated by communities whose dominant overstories are big sagebrush, silver sagebrush or skunkbush sumac, all with a grass understory. Although some areas of the Busby soil are cultivated, the sandy soils are better used for livestock grazing, due to their low available water capacity and susceptibility to wind and water erosion.

Loamy Alluvial Soils

This group of soils, formed in loamy alluvial materials, is found on alluvial fans and drainage side slopes. The group makes up 14 percent of the total disturbance area and includes the Kremlin, Cooers and Yamac soils.

Surface texture is generally a loam, with subsoil and substratum textures ranging from sandy loams to clay loams. All of these soils are deep, with bedrock generally occurring below 60 inches. Available water capacity in these soils is high and permeability is moderate to moderately slow.

Vegetation communities occurring on these soils are dominated by either big sagebrush or silver sagebrush. The grassland community is also found on some of these soils. Past land use of these soils has been either small grain and hay cropland or livestock grazing. Climatic conditions, primarily a short frost-free period, limit their use as cropland.

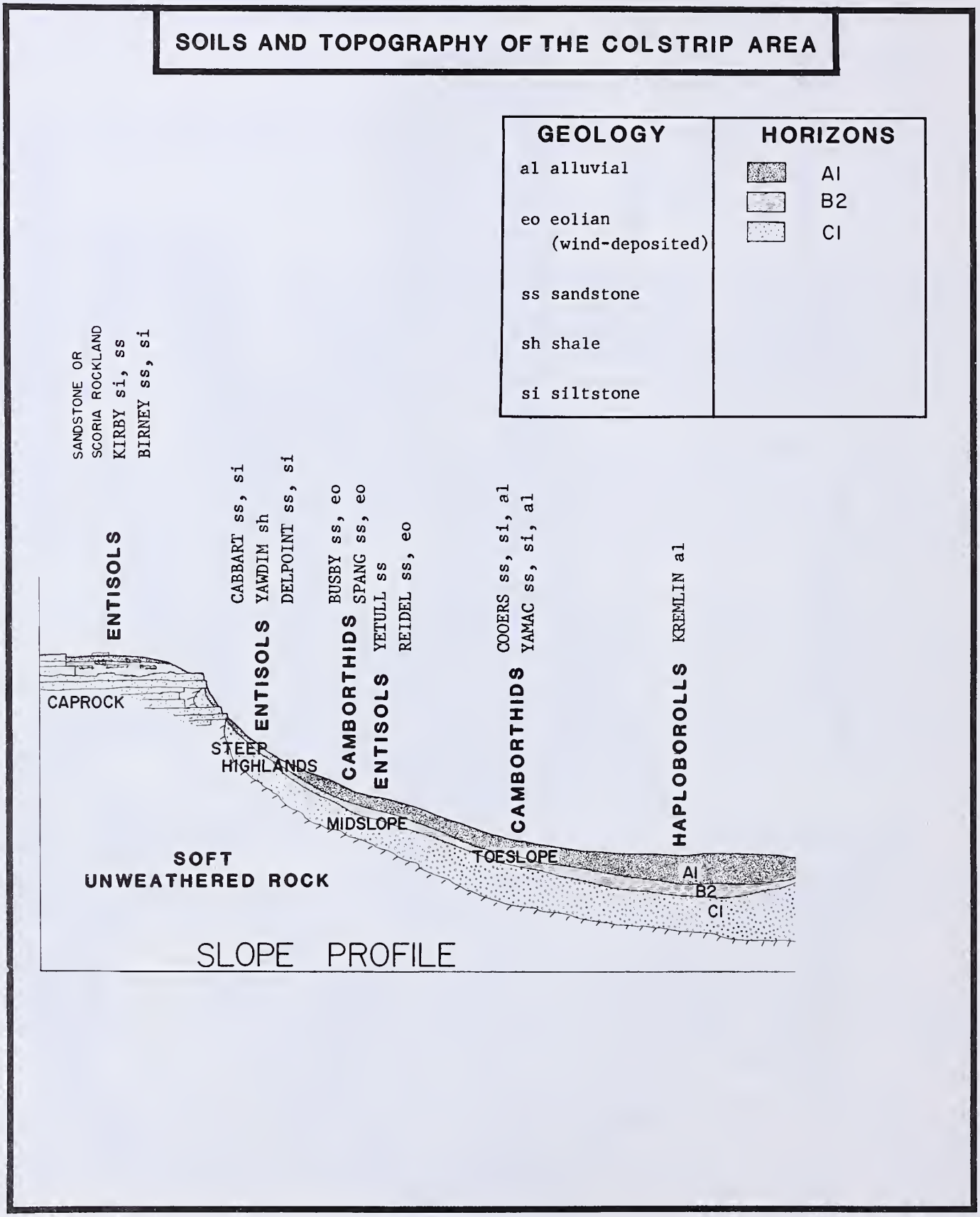

FIGURE II-6

Soils are in part derived from parent materials (such as bedrock) and topographic position. These relationships in the Colstrip Area are shown schematically above. (Based on Schafer et al., 1979.)

Residual Soils

This is the largest of the four major soil groups, covering 37 percent of the total disturbance area. The soils in this group formed in place over sandstones, siltstones, or shales. They are found on upland ridges and side slopes. Soil series include Delpoint, Cabbart, Yawdim, and Rentsac.

Textures vary, depending on the underlying bedrock. Loams and clay loams are the dominant surface textures; subsurface layers range from sandy loams and silt loams to clay loams and silty clay loams. Depth to bedrock ranges from 5 to 40 inches and is generally 10 to 30 inches. Available water capacity is low to moderate, depending on the depth to bedrock. Permeability is moderate to moderately slow.

The major vegetation type growing on this group is ponderosa pine-grassland, which is dominated by ponderosa pine, Rocky Mountain juniper, and bluebunch wheatgrass. Livestock grazing and wildlife habitat are the dominant land uses.

Porcellanite-Derived Soils

This group of soils formed in residual materials derived from porcellanite, commonly called scoria or clinker, which formed by sandstone and shale being baked by burning coal. The porcellanite-derived soils occur on upland ridges, side slopes, and associated alluvial fans and comprise 14 percent of the total disturbance area. These soils include the Birney and Kirby series, with the Cooers, Cabbart, and Spang soils usually found in association.

Surface textures are loams or sandy loams, and subsurface layers range from sandy loams and silt loams to loams. Rock fragment content, usually shale fragments, ranges up to 70 percent and increases with depth. Usually the lower substratum of these soils is made up entirely of fractured porcellanite. Available water capacity is low to moderate, depending on depth to porcellanite. Permeability is moderate to moderately rapid.

Ponderosa pine-grassland is the dominant vegetation type; silver sagebrush and skunkbush sumac communities grow on the lower slopes. Livestock grazing and wildlife habitat are the major uses of these soils.

Mine Spoil

Approximately 10 percent of the total disturbance area consists of mine spoil, both raw and regraded. The regraded spoil has been seeded and the raw spoil partially vegetated by volunteer (naturally propagated) plants. The spoil lies entirely within the application area.

Soil Productivity

The Soil Conservation Service (SCS) has estimated average potential productivity for some of the map units in Area D. Estimates range from 800 to 2,000 pounds per acre during favorable precipitation years and 500 to 800 pounds per acre during unfavorable precipitation years.

The SCS has also assigned land capability classes and subclasses to some of the map units. In this system, eight classes form two major groups: those suited for cultivation (classes I-IV) and those unsuited for cultivation (classes V-VIII). The soils in the sandy soils and loamy alluvial soils groups are suitable for cultivation. These soils are either in class III or IV; cultivation of these soils is somewhat limited due to slope steepness, short frost-free growing season, and/or low available water capacity. Residual soils and the porcellanite-derived soils are generally unsuited for cultivation and are in class VI or VII. Major limitations to cultivated use are shallow depth to bedrock, low available water capacity, and slope steepness.

Soil Suitability for Reclamation

Each soil type found in Area D was evaluated by Western Energy Company for its suitability as a plant growth medium. Each will be briefly discussed below.

The sandy soils group consists of the Busby, Reidel, Spang, and Yetull series, all of which, with the exception of Reidel, are deeper than 40 inches. Reidel has bedrock at a depth between 20 and 40 inches. The main limitation to the use of these soils in revegetation is the very sandy textures (loamy sands and loamy fine sands) of the subsurface layers. These soil textures are easily eroded by wind and have low available water capacity. The potential water erosion hazard is moderate to high in these soils.

The loamy alluvial soils group includes the Kremlin, Cooers, and Yamac series. The Kremlin and Cooers soils are suitable for use in revegetation. The Yamac soils have unsuitably high salinity levels at varying depths in the profile. Western Energy analyzed samples from five Yamac soils in Area D. Only one had high salinity levels within the proposed 60-inch stripping depth. The sample site is located north of Pony Creek in an area that would not be disturbed. The prestripping soil sampling program, discussed in Chapter III, would assist in identifying the location of other soils with unsuitably high levels of salinity.

Both the Cooers and the Yamac soils have moderately high carbonate levels (10-20 percent) at varying depths, usually between 20 and 40 inches. Elevated carbonate levels are generally associated with reduced availability of phosphorus and magnesium and other essential plant nutrients. The potential erosion hazard is moderate to high for water erosion and slight for wind erosion in this group of soils.

The Delpoint, Cabbart, Rentsac and Yawdim make up the residual soils group. The Delpoint, Rentsac, and Cabbart soils have moderately high carbonate levels (10-20 percent), which occur throughout the Cabbart and Rentsac profiles, and below 6 to 12 inches in the Delpoint soils. The Yawdim soil has layers, usually below 6 inches, unsuitably high in clay content. Carbonate

Carbonate levels are also moderately high below this depth. Like the loamy alluvial soils, this group of soils has a low wind erosion hazard and a moderate to high water erosion hazard.

The two dominant soils in the porcellanite-derived soils group are the Kirby and Birney series. Their limitation for use as a plant growth medium is unsuitably high volumes of rock fragments, usually shale chips, that are generally found between 6 and 12 inches below the surface. These soils also have moderately high carbonate levels. The potential hazard for wind and water erosion is moderate in these soils.

VEGETATION

Vegetation Types

The vegetation of Area D has been classified into eight vegetation and five disturbance types (table II-1). The composition and extent of these vegetation communities are controlled by factors such as soil conditions, topography, moisture availability, and past land use. The drier upland sites are dominated by grasslands; the drainages and north-facing slopes support ponderosa pine (Pinus ponderosa), Rocky Mountain juniper (Juniperus scopulorum), and shrubs adapted to moister soil conditions.

Historically, the native vegetation has been altered by grazing, cultivation, and surface mining. As a result, the vegetation now includes more introduced plant species, and grazing capacity has declined. Heavy grazing has reduced the amounts of some desirable forage plants ("decreaser species") and has enhanced the proliferation of relatively unpalatable plants ("increaser species"). Invader species (e.g., those which aggressively colonize areas of disturbance) such as cheatgrass (Bromus tectorum) and Japanese brome (Bromus japonicus) have become widespread.

The eight vegetation types of Area D have been described and mapped by ECON, a consultant to Western Energy (Western Energy Company, 1984a, vol. 7, app. K). Species dominance was determined by canopy coverage estimates. Measurements of production and species composition, however, have been reported only for the four major vegetation types that occur in the application area (grassland, silver sagebrush-grassland, skunkbush sumac-grassland, and ponderosa pine grassland). The minor types (rubber rabbitbrush, spoil, big sagebrush-grassland, and disturbed grassland) have not been sampled in Area D, but have been sampled for other areas of the Rosebud Mine during baseline vegetation studies (ECON, 1982 and 1983). The vegetation types in Area D are described below.

Grassland

The grassland vegetation type is dominated by needle-and-thread (Stipa comata) and blue grama (Bouteloua gracilis). Other common species include western wheatgrass (Agropyron smithii), threadleaf sedge (Carex filifolia), and

TABLE II-1

Affected Acreages in Application and Life-of-Mine Areas

Type	Application Area		Life-of-Mine Area	
	Disturbed Acreage	Percent of Total Acreage Disturbed	Disturbed Acreage	Percent of Total Acreage Disturbed
Grassland	1,025[1]	39.2	286	33.6
Big sagebrush-grassland	12	0.4	0	0.0
Silver sagebrush-grassland	107	4.1	27	3.2
Skunkbush sumac-grassland	130	5.0	180	21.2
Rubber rabbitbrush	6	0.2	0	0.0
Ponderosa pine-grassland	830	31.7	293	34.5
Agricultural	120	4.6	7	0.8
Disturbed grassland	10	0.4	53	6.2
Ungraded mine spoil	165	6.4	4	0.5
Regraded mine spoil	185	7.1	0	0.0
Sandstone outcrops	3	0.1	0	0.0
Ponds	18	0.7	0	0.0
Ranchyard	4	0.1	0	0.0
Total	2,615	100.0	850	100.0

Source: Western Energy Company, 1984a.

[1]Acreage includes approximately 2 acres of upland deciduous shrub type.

prairie junegrass (Koeleria cristata). The dominant grasses in this type are increaser species, reflecting past grazing pressure.

The total ground cover of this type is 60 percent grass, 9 percent forbs, and 5 percent shrubs. The most common forbs are broom snakeweed (Xanthocephalum sarothrae), cudweed sagewort (Artemisia ludoviciana), scarlet gaura (Gaura coccinea), and hairy goldaster (Chrysopsis villosa). The most common shrubs are silver sagebrush (Artemisia cana) and yucca (Yucca glauca).

One small wet area (less than 1 acre) in the upper Pony Creek drainage supports a stand of water-dependent sedges (Carex spp.) and rushes (Juncus spp.). The wet area, fed by spring No. 24, results from the Rosebud Coal seam's intercepting the drainage at the surface and releasing water as spring flow. Because there is no shrub or tree overstory at this site, this area of vegetation is considered part of the grassland vegetation type.

Silver Sagebrush-Grassland

The dominant shrub in this vegetation type is silver sagebrush. The dominant grasses are western wheatgrass and Kentucky bluegrass (Poa pratensis). Other common grasses include green needlegrass (Stipa viridula), needle-and-thread,

blue grama, and prairie junegrass. The most common forbs in this type are western yarrow (Achillea millefolium), Hood's phlox (Phlox hoodii), and scarlet guara.

Approximately 22 percent of the ground cover of this type is silver sagebrush (mean density of 16,950 plants per acre) with 13 percent being big sagebrush (Artemisia tridentata), gooseberry (Ribes spp.), and western snowberry (Symphoricarpos occidentalis). Forb species account for 13 percent of the vegetative cover and grasses 40 percent.

Skunkbush Sumac-Grassland

This vegetation type typically occurs over scoria outcrops with shallow topsoils. Blue grama and needle-and-thread are the dominant grasses and skunkbush sumac (Rhus trilobata) is the dominant shrub (density of approximately 2,550 per acre). Common forbs include false-tarragon sagewort (Artemisia dracunculus), hairy goldaster, cudweed sagewort, and downy paintbrush (Castilleja sessiliflora).

Approximately 9 percent of the ground cover is skunkbush sumac, with grass accounting for 25 percent and forbs contributing 10 percent. Relatively large amounts of bare ground and rock occur within this type.

Big Sagebrush-Grassland

This type occurs in small isolated stands scattered among the more extensive vegetation types in Area D. Big sagebrush is the dominant shrub. Grasses and forbs typical of the grassland type form the herbaceous understory.

Rubber Rabbitbrush

This type occurs in small stands on exposed hills and ridges underlain by highly eroded clays and siltstones. The dominant shrub is rubber rabbitbrush (Chrysothamnus nauseosus). Dominant understory plants include Nuttal goldenweed (Haplopappus nuttallii), few-flowered buckwheat (Eriogonum pauciflorum var. pauciflorum), and bluebunch wheatgrass (Agropyron spicatum).

Ponderosa Pine-Grassland

This type is commonly associated with silty and sandy loams in drainage bottoms and shallow rocky soils on ridges and steep side slopes. The dominant tree is ponderosa pine (mean density of 24 trees per acre), although Rocky Mountain juniper is also common (mean density of 11 trees per acre). The tree canopy coverage of this type varies: The thickest stands grow in narrow drainages and on north slopes and more open stands grow on shallow soils and gentler slopes.

Grasses cover approximately 40 percent of the type's understory. Bluebunch wheatgrass, sunsedge (Carex pennsylvanica), and side-oats grama (Bouteloua curtipendula) dominate. Forb coverage is similar to the grassland type:

Common forbs are western yarrow, meadow aster (Aster campestris), black samson (Echinacea pallida), and Hood's phlox.

Spoil

Ungraded mining spoil occupies 165 acres, and regraded spoil 185 acres, of the Area D disturbance acreage. Ungraded spoil piles are being colonized by rubber rabbitbrush, crested wheatgrass (Agropyron cristatum), western wheatgrass, and Indian ricegrass (Oryzopsis hymenoides. Plains cottonwood (Populus deltoides) grows at low elevations where relatively high water levels persist throughout the growing season.

The regraded spoil was graded and partially seeded in 1971 and 1983. It currently is dominated by crested wheatgrass, alfalfa (Medicago sativa), and yellow sweetclover (Melilotus officinalis). Additional native and introduced species are also becoming established.

Upland Deciduous Shrub

The upland deciduous shrub type grows in small areas (approximately 2 acres) in the upper reaches of the dissected drainages where higher moisture levels prevail. Although there have been no data collected for this type in Area D, Department of State Lands personnel report that the dominant shrubs are chokecherry (Prunus virginiana), snowberry, and rose (Rosa woodsii), with occasional box elder (Acer negundo) and green ash (Fraxinus pennsylvanica) trees.

Disturbed Grassland

This type occurs on abandoned crop fields and is dominated by crested wheatgrass, alfalfa, and various colonizing native and invader species. Typically, this type is used as pasture or cut for hay.

Rare, Threatened, or Endangered Species

Pursuant to section 7 of the Federal Endangered Species Act, OSM consulted with the U.S. Fish and Wildlife Service for the listed species that could occur in the vicinity of Area D. The list provided by the U.S. Fish and Wildlife Service did not contain any plant species. Therefore, the proposed plan would not affect any federal threatened or endangered plants; however, the following four species listed by Lesica et al. (1984, Montana Rare Plant Project) as rare, threatened, or endangered could occur within Area D: Eupatorium maculatum var. bruneri (threatened), Carex gravida var. gravida (threatened), and Eriogonum pauciflorum var. canum (rare). None of these plants have been collected or observed on the minesite.

Prime Farmland

The Soil Conservation Service has determined that none of the soils in Area D meet the criteria for prime farmland.

Range Condition and Recommended Stocking Rates

The condition of the 2,110 acres of rangeland (Western Energy Company, 1984a, vol. 7, app. K, table 8) in the application area is rated as fair to good (approximately 50 to 75 percent of the climax condition) using methods devised by the U.S. Department of Agriculture, Soil Conservation Service (1977). Based on this range condition, the recommended stocking rate is 80 cow-calf units for a 9-month grazing season (2.94 acres per cow-calf unit per month).

No data have been collected on the range condition of the life-of-mine expansion. Assuming that the life-of-mine expansion and application area are similar, 786 acres of SCS-designated rangeland (i.e., acreage of the first six vegetation types in table II-1) in the life-of-mine expansion would have a recommended stocking rate of approximately 30 cow-calf units for a 9-month grazing season.

The recommended stocking rates for the application area and life-of-mine expansion are lower than if the range were in excellent condition (i.e., 75 percent or better of climax). Assuming excellent condition, the potential stocking rate for the 2,896 acres of rangeland to be disturbed in Area D would be in excess of 145 cow-calf units for a nine-month grazing season (2.2 or fewer acres per cow-calf unit per month).

Agricultural Land

The 120 acres of cropland in the application area produce dryland wheat, alfalfa, and hay. Based on ten-year production averages for Rosebud County (Montana Department of Agriculture and Statistical Reporting Service, U.S. Department of Agriculture, 1972-81), wheat production can be expected to be 29 bushels per acre and alfalfa and hay production 1 to 2 tons per acre.

WILDLIFE

Area D, like the rest of the Rosebud Mine, is characterized by the gently sloping (less than 10 percent) hills and coulees of upper Cow Creek and the steeper sloping (30-40 percent) dissected drainages of Pony Creek and Spring Creek.

Wildlife habitat types in Area D include grassland, shrub-grassland, conifer-grassland, cropland, disturbed grassland, spoil, sandstone outcrop, spoil pond and upland deciduous shrub/tree (limited in size and value to wildlife). Vegetation types are similar, but list more specific shrub types. (See Vegetation.) Wildlife habitats within Area D have little surface water (see Hydrology) available to wildlife and have been heavily grazed for many years. Native vegetation, including some plants wildlife prefer, has been reduced by competition with introduced plant species. Table II-2 lists the acreage of wildlife habitat to be disturbed on the Rosebud Mine, including Area D.

TABLE II-2

Wildlife Habitat to be Disturbed on Rosebud Mine
(in acres)

Wildlife Habitat	Areas A, B, C, & E	Area D Application Area	Area D Life-of-Mine Area	Percent[1] Total within Area D
Grassland	5,237	1,025[3]	286	20
Shrub-Grassland	4,910	255	207	9
Conifer-Grassland	1,206	830	293	48
Cropland	1,550	120	7	8
Disturbed Grassland	546	10	53	10
Spoil	805	350	4	31
Sandstone Outcrop	--[2]	3	--	--
Spoil Pond	--	18	--	--
TOTAL	14,254	2,611[4]	850	

Source: Western Energy Company, 1984a.
Montana Department of State Lands and Office of Surface Mining, 1983a.

[1]Total Rosebud Mine disturbance area.

[2]Acreages not available.

[3]Includes approximately 2 acres of upland deciduous shrub type.

[4]Does not include 4 acres of ranchyard.

Three trampled seeps (springs 39, 40, and 41) are located in one coulee within section 24 and receive limited wildlife use. (See Hydrology.) Three springs located just outside the Area D disturbance area (Nos. 23, 24, 26) are also used by wildlife. One perennial pond is located in the spoil area of section 26.

Approximately three acres of rock outcrops lie within Area D. Several more outcrops, including cliff faces suitable for nesting raptors, are found within one mile of the area to be disturbed.

Big Game

Wildlife studies at Western Energy Company's Rosebud Mine were conducted from 1973 to 1979 by Ecological Consulting Service, Inc., and from 1980 to the present by Western Energy Company's biologists. The Rosebud Mine wildlife study

area included 200 square miles from 1973 through 1977. From 1978 through 1981, the study area covered 160 square miles. The study area was reduced in 1982 to the 56-square-mile Area D study area.

Most game species common to southeast Montana have been sighted on Area D. Data on big game in Area D have been gathered by monthly aerial survey and incidental observation since 1973. No systematic foot or vehicle observation routes have been established on Area D.

Mule Deer

Mule deer are the most abundant big game species at the Rosebud Mine and in Area D. They are also an important asset to the Montana Department of Fish, Wildlife, and Parks, which draws revenue from the sale of hunting licenses.

Area D, as well as other portions of the Rosebud Mine, appear to support more mule deer during fall, winter, and spring than during summer. Observations of mule deer on Area D during fall, winter, and spring from 1978 to 1982 have ranged from 17 to 19 percent of all Rosebud Mine mule deer observed (table II-3). Summer mule deer sightings on Area D have been very low (8 percent of the total). Observations on the Area D (56-square-mile) study area and the 160-square-mile study area also indicate lower use of the area during summer than during other seasons (tables II-3 and II-4).

Fewer sightings during summer months may not necessarily indicate that there are fewer deer in the area at this time. It is possible that deer are using the heavy cover of conifers and shrubs for shade and are less visible during the daylight hours when wildlife surveys are performed. Biggins (1976) documented increased use of heavy cover (ponderosa pine and shrubby coulees) during summer months in southeast Montana. On the Rosebud Mine study areas, summer observations of mule deer showed use of the heavy cover areas of creek bottoms, conifer-grassland, and shrub-grassland. Summer-fall studies have documented increased mule deer use of ponderosa pine hills and breaks (Mackie, 1970, pp. 50-57; Dusek, 1971, 1976; Biggins, 1976). Summer spotlight surveys in southeast Montana have shown that mule deer move into cropland at night to feed and into the cover of breaks and trees at daybreak (Olson, Elliott and Associates 1980, pp. 45-52; OEA Research 1981, pp. 40-51).

Mule deer in the Area D study area use the shrub-grassland habitat the most, followed in order by creek bottom (not occurring on Area D), cropland, conifer-grassland, and grassland (table II-4).

Seasonal use of habitat by mule deer on the Area D study area in 1980-81 was similar to use on the larger Rosebud Mine 160-square-mile area and other areas in southeast Montana. Mule deer mostly used shrub-grassland habitat during winter on both study areas (56-square-mile and 160-square-mile). Phillips (1979, p. 9) noted that mule deer winter habitat in southeast Montana contains the important browse species of sagebrush, skunkbush sumac, and rubber rabbitbrush. These species, together with Nuttal saltbush, winterfat, and selected forbs provide high quality forage during critical winter periods (Olson, Elliott and Associates, 1980, pp. 45-52; Knapp, 1972, pp. 20-33). Mule deer on the Rosebud Mine study areas may also select shrub-grassland habitat in winter because of the terrain in which it is located. Mule deer

TABLE II-3

Mule Deer Aerial Observation, Rosebud Mine, 1978-1982

	Winter	Spring	Summer	Fall	Total
Area A (2,865 acres)[2]	5 (23)[1]	5 (23)	12 (23)	17 (51)	39 (120)
Area B (2,714 acres)	3 (18)	7 (41)	9 (23)	25 (93)	44 (175)
Area C (7,676 acres)	2 (24)	18 (111)	24 (50)	18 (70)	62 (255)
Area D (3,465 acres)	5 (19) [19%][3]	12 (41) [18%]	5 (9) [8%]	11 (44) [17%]	33 (113) [16%]
Area E (1,896 acres)	4 (14)	4 (17)	5 (10)	1 (1)	14 (42)
Total	19 (98)	46 (233)	55 (115)	72 (259)	192 (705)

Source: Western Energy Company, 1980-1982.

[1]Number of observations (number of animals observed).

[2]Area to be disturbed.

[3]Percent of Rosebud Mine individuals observed within Area D.

TABLE II-4

Seasonal Use of Habitat by Mule Deer on the 56-Square-Mile Area D Wildlife Study Area, 1980-1981

Habitat	Winter 131 (27)[1]	Spring 116 (32)	Summer 52 (26)	Fall 209 (54)	Total[1] 510 (139)
Grassland	13 (15)[2]	17 (25)	2 (4)	9 (11)	11 (14)
Shrub-Grassland	49 (48)	21 (31)	17 (16)	22 (27)	28 (26)
Conifer-Grassland	21 (19)	7 (9)	20 (19)	12 (17)	14 (16)
Cropland	10 (7)	26 (9)	9 (8)	12 (7)	15 (8)
Disturbed Grassland	--	4 (3)	6 (12)	trace (2)	2 (4)
Creek Bottom/ Coulee Bottom[3]	2 (4)	19 (16)	26 (27)	39 (39)	24 (24)
Reclamation	5 (7)	5 (6)	20 (15)	5 (7)	7 (9)

Source: Western Energy Company, 1984a.

[1]Number of animals observed (number of observations).

[2]Percent of animals observed (percent of number of observations).

[3]This habitat does not occur within Area D but is common on East Fork Armells Creek, within the 56-square-mile Area D wildlife study area.

select steep hillsides during late fall and winter because of food availability on wind-swept areas and because of the presence of escape and thermal cover (Dusek, 1971; Olson, Elliott and Associates, 1980, pp. 45-52; Thomas, 1979, pp. 104-127).

In spring mule deer on both study areas (56- and 160-square-mile) mostly used cropland, shrub-grassland, and grassland. These areas provide mule deer with succulent forbs and grass during green-up. Knapp (1972, pp. 20-33) suggested that mule deer use these areas on the Tongue River south of Colstrip because of availability of lush grass and forbs.

In fall mule deer on the Rosebud Mine study areas mostly used bottoms and shrub-grassland. Conifer-grassland, grassland, and cropland also received use. Dessicated vegetation in the fall may cause mule deer to use a variety of habitats during the search for the succulent plants they prefer.

Mule deer productivity on the 160-square-mile study area surrounding Area D has varied considerably from 1973 to 1981 (fig. II-7). Ratios of fawns per 100 does have ranged from as low as 56:100 in 1980 to as many as 95:100 in 1981; the 9-year average is 68:100. Productivity on the entire Rosebud Mine has increased dramatically since the severe winters of 1977-78 and 1978-79. Montana Department of Fish, Wildlife, and Parks Region 7 (southeast Montana) 1975-81 mule deer fall counts showed as few as 66 to as many as 101 fawns per 100 does. Hunting District 722 (Colstrip area) data for 1981 listed 86 fawns per 100 does. A low number of fawns per 100 does may reflect poor productivity. However, low fawn:doe ratios may also indicate an increase in the non-producing yearling population. Yearling animals may be indistinguishable from adults, thus creating an apparent, but artificially low ratio. Adult does may actually be producing a higher ratio of fawns at these times.

No mule deer fawning areas have been delineated on Area D or any other portion of the Rosebud Mine complex. Observations of lone does in late May and June probably indicate the doe has or is about to give birth to a fawn. June observations of does on Area D and on the entire Rosebud Mine have been concentrated in areas containing heavy tree and shrub cover or tall forbs, grasses, or alfalfa. Portions of Area D provide these habitat components for fawning mule deer.

White-Tailed Deer

Some white-tailed deer have been observed on the Rosebud Mine study areas, but none in Area D. Area D lacks the bottomland habitat whitetails prefer, which may discourage whitetail use. Riparian habitat along East Fork Armells Creek and Rosebud Creek (fig. I-1) is better suited to whitetails. Observations of whitetails have been made in these areas. Allen (1968, pp. 134-137) found that cover provided by cottonwood, willow, and riparian shrubs is important to whitetails year-round. Martinka (1968, pp. 561-562) found that deciduous bottomland and alfalfa are important to whitetails.

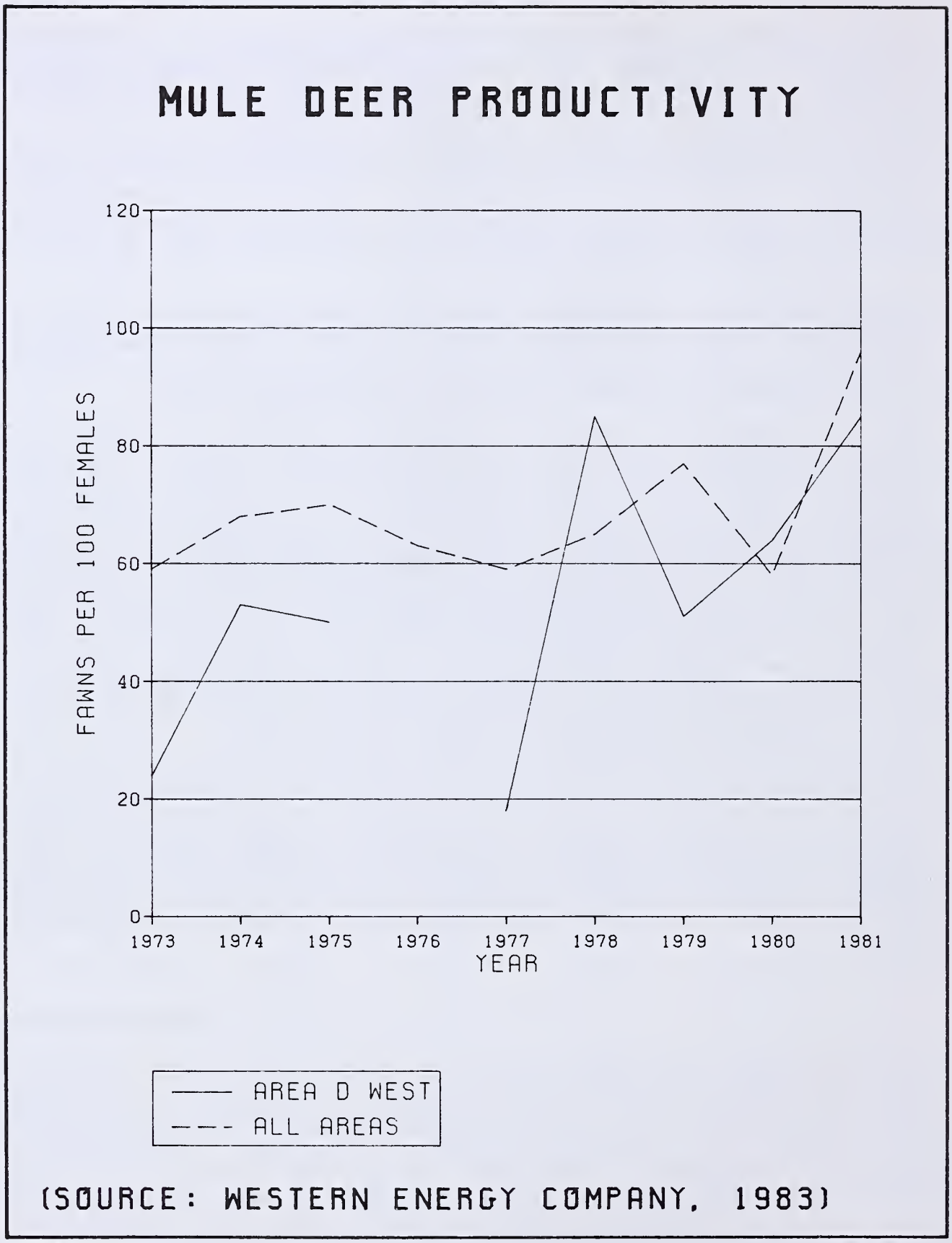

FIGURE II-7

Mule deer productivity on Area D has varied erratically since 1973. Productivity on the Rosebud Mine as a whole since 1973 has been more stable.

Pronghorn

Aerial surveys of the Rosebud Mine study area indicate limited use of Area D by pronghorn (table II-5). Only 9 percent of 1,044 Rosebud Mine pronghorn sightings were made on Area D. Pronghorn have been observed on Area D during spring, summer, and fall, but not during winter.

TABLE II-5

Pronghorn Aerial Observations, Rosebud Mine, 1978-1982

	Winter	Spring	Summer	Fall	Total
Area A (2,865 acres)[2]	1 (2)[1]	15 (58)	9 (41)	2 (11)	27 (112)
Area B (2,714 acres)	3 (48)	14 (85)	10 (72)	11 (80)	38 (285)
Area C (7,676 acres)	4 (60)	48 (165)	32 (101)	22 (222)	106 (548)
Area D (3,465 acres)	0 (0) [0%][3]	8 (42) [12%]	7 (30) [12%]	4 (19) [6%]	19 (91) [9%]
Area E (1,896 acres)	0 (0)	2 (2)	2 (6)	0 (0)	4 (8)
Total	8 (110)	87 (352)	60 (250)	39 (332)	194 (1044)

Source: Western Energy Company, 1980-1982.

[1]Number of observations (number of animals observed).

[2]Area to be disturbed.

[3]Percent of Rosebud Mine individuals observed within Area D.

Pronghorn on the Area D study area have mainly used grassland (65 percent of 434 individuals) and shrub-grassland (26 percent) (table II-6). Grassland was used more than any other habitat during winter, spring, and summer. Shrub-grassland was used slightly more than grassland during fall. Cropland was also used fairly heavily during fall.

Area D may receive limited use by pronghorn because only 20 percent of the available grassland and 9 percent of shrub-grassland within the Rosebud Mine occur there. Also, topography may be too rugged. Studies of pronghorn in southeast Montana have documented that sagebrush and shrubby vegetation types are important year-round and that pronghorn prefer gently to moderately sloping (less than 10 percent) land (Amstrup, 1978, pp. 13-14). In Wyoming, Severson and May (1967) also documented the importance of sagebrush habitats. Pronghorn prefer undulating, wide-open, expansive terrain (Yoakum, 1980, pp.

TABLE II-6

Seasonal Use of Habitat by Pronghorn on the 56-Square-Mile Area D Wildlife Study Area, 1980-1981

Habitat	Winter 98 (7)[1]	Spring 111 (27)	Summer 109 (26)	Fall 116 (17)	Total 434 (77)
Grassland	80 (86)[2]	71 (67)	75 (62)	35 (53)	65 (64)
Shrub-Grassland	20 (14)	27 (23)	18 (27)	37 (30)	26 (26)
Conifer-Grassland	--	1 (4)	--	--	--
Cropland	--	--	1 (4)	27 (18)	7 (5)
Other	--	1 (4)	6 (10)	--	2 (2)

Source: Western Energy Company, 1984a.

[1]Number of animals observed (number of observations).

[2]Percent of animals observed (percent of number of observations).

5-16) and have demonstrated an affinity for succulent grasses and forbs during spring green-up (Amstrup, 1978, pp. 13-14; Cole and Wilkins, 1958, p. 19).

Pronghorn productivity on the Rosebud Mine averaged 39 fawns per 100 does between 1973 and 1981, with a low of 18 per 100 in 1976 and a high of 64 per 100 in 1981. Productivity of pronghorn in high quality habitat may average as high as 180 fawns per 100 does (Yoakum, 1980, pp. 5-16). High fawn:doe ratios have been correlated with high quality and succulent vegetative conditions in the plains states.

Conditions at the Rosebud Mine, Area D in particular, are reported to be less than high quality (ECON, 1973-78; Western Energy Co., 1979-83). Montana Department of Fish, Wildlife, and Parks' Hunting District 722 (Colstrip area) pronghorn productivity data showed an average of 45 fawns per 100 does between 1972 and 1981. This information suggests that high quality pronghorn habitat in the Colstrip vicinity is limited.

No pronghorn fawning areas have been delineated in Area D. The moderate to dense sagebrush cover, which provides optimum fawning habitat (Yoakum, 1980, pp. 5-16), is not common in Area D.

Other Mammals

Predators

Coyotes have been sighted throughout the Rosebud Mine study areas every year since 1972. Based on limited field observations, coyotes do not seem to prefer any particular habitat on the Rosebud Mine.

Red foxes, badgers, raccoons, and bobcats have been observed only infrequently on the Rosebud Mine study areas. They have never been observed, but may occur on Area D.

Medium and Small Mammals

No small mammal studies have been undertaken in Area D. Incidental observations have included cottontails, white-tailed jackrabbits, thirteen-lined ground squirrels, and porcupines.

Limited trapping elsewhere on the Rosebud Mine in a variety of habitats produced deer mice, prairie voles, house mice, and western harvest mice. Deer mice were most abundant in every habitat.

Upland Game Birds

Sharp-tailed Grouse

Area D does not completely satisfy year-round habitat needs for sharptails. In most grassland areas, native plants are decreasing, introduced plants are increasing, and grazing by livestock has been heavy. Mesic upland coulees supporting such species as snowberry, rose, chokecherry, serviceberry, and hawthorne are limited or in poor condition on Area D. Two habitat features are necessary for sharp-tailed grouse: (1) residual stands of native grasses for shelter, protection, roosting, and nesting; and (2) dense tree and shrub cover for food, rest, escape, and thermal protection (Brown, 1971, pp. 129-133). Swenson (1981, pp. 6-8) demonstrated the year-round importance of shrubby coulees to sharptails in southeastern Montana.

One sharp-tailed grouse dancing ground (No. 11) is located in the northwest quarter of section 30 in the eastern part of the Area D life-of-mine expansion. An additional dancing ground (No. 15) is located just outside the life-of-mine boundary in the southeast quarter of section 29. Attendance at lek 11 ranged from 2 to 15 male grouse from 1973 to 1981, averaging 10.7 during those 9 years. Attendance at lek 15 ranged from 7 to 15 male grouse from 1974 to 1981, averaging 10.4 for those eight years.

No sharptail productivity data are available for Area D. Nesting habitat (relatively dense shrubby vegetation or grass) is limited.

Turkey

Habitat use by turkeys on Area D is concentrated in ponderosa pine-grassland, grassland, and shrub-grassland and is consistent with habitat use by turkeys in most of southeast Montana. Jonas (1966, p. 11) showed that grassland communities provided 36 percent of turkey observations, shrubby vegetation 28 percent, and ponderosa pine 23 percent. Most birds sighted by Jonas were within 100 yards of tree or shrub cover.

Since 1977, 21 groups totaling 144 birds have been recorded on the Area D study area. Eight of these groups were observed within the Area D application area and life-of-mine expansion.

Other Upland Game Birds

There have been no observations of ring-necked pheasant, sage grouse, or Hungarian (gray) partridge within Area D. Ring-necked pheasants in southeastern Montana are often found using the dense cover of riparian areas intermingled with grain or alfalfa fields (Janson et al., 1971). Hungarian partridge require an interspersion of heavy forb or shrub cover and grain fields (Trueblood and Wergard, 1971). Sage grouse require large tracts of sparse to very dense sagebrush habitat year-round (Patterson, 1952). The habitat these birds prefer does not exist in Area D.

Waterfowl

Sixteen species of waterfowl have been recorded on the Area D study area. Four species, mallard, American wigeon, northern shoveler, and blue-winged teal, have nested in the area. Although the location of neither the nest sites nor the observations have been recorded, most birds within Area D were probably observed on the spoil pond in section 26 of the application area.

Songbirds

Songbird surveys have not been conducted in Area D. Bird diversity in Area D may be limited by habitat diversity. The birds that probably frequent the area are those associated with upland grasslands (including Brewer's sparrow, lark sparrow, vesper sparrow, western meadowlark, lark bunting) and ponderosa pine (including black-capped chickadee, red-breasted nuthatch, rufous-sided towhee, chipping sparrow, American robin, common flicker, red-headed wood pecker, and pine siskin).

Raptors

Eleven species of raptors have been observed on the Area D study area since 1974. The application area and life-of-mine expansion did not provide many observations. Four species have been observed: red-tailed hawk, northern harrier, rough-legged hawk, and Cooper's hawk. A prairie falcon and great horned owl nested successfully in 1983 and 1984 on Eagle Rock, less than one-half mile north of the application area in section 14 (Bruce Waage, Western Energy Company, pers. comm. August 21, 1984). There are no known nesting raptors on either the Area D application area or life-of-mine expansion.

Reptiles and Amphibians

Incidental observations on the Rosebud Mine study area have provided records of the following species which probably occur on Area D: prairie rattlesnake,

bull snake, garter snake, racer, snapping turtle, painted turtle, Rocky Mountain toad, sagebrush lizard, chorus frog, leopard frog, tiger salamander.

The turtles, frogs, and salamander are probably associated with the old spoil pond. Other species are probably present in most habitats.

Threatened and Endangered Species

Pursuant to section 7 of the Federal Endangered Species Act, OSM consulted with the U.S. Fish and Wildlife Service for the listed species that could inhabit the Area D vicinity. The Fish and Wildlife Service responded with a list containing the peregrine falcon, bald eagle, and the black-footed ferret. However, there have been no observations of threatened or endangered species in Area D. Migrating bald eagles and a peregrine falcon have been observed in the Colstrip area (Montana Department of State Lands and U.S. Office of Surface Mining, 1983a), but no critical habitat (nesting or roosting) exists in the area for either species. Moreover, no black-footed ferrets have been observed in the prairie dog town north of Area A on Stocker Creek or in any other portion of Rosebud County.

CLIMATE

The semiarid climate at Colstrip is characterized by insufficient moisture to sustain dense vegetative growth (Critchfield, 1966). The climate is typical of the continental steppes of the northern Great Plains. Precipitation is low but variable and falls primarily during the warmer months. Diurnal and seasonal temperatures range widely. Surface humidity is low. Prevailing wind speeds are moderate.

Precipitation

Mean annual precipitation is 15.8 inches, over 70 percent of which falls from April through September. At least 0.01 inches of precipitation fall on each of at least 95 days in an average year. Recurrence intervals for 1-, 6-, and 24-hour precipitation events (e.g. rainstorms, snowfalls) are presented in table II-7. Snowfall averages about 35 inches per year.

Consumptive water use (total moisture loss from soil surface evaporation, plant growth, and transpiration) is calculated to be 22.8 inches (Toy and Munson, 1978). Since this exceeds annual precipitation by seven inches, moisture deficiency affects vegetation development and reclamation success.

Temperature

The average annual temperature in Colstrip is about 45° F. January is the coldest month with an average temperature of 21° F and an average minimum

TABLE II-7

Maximum Amount of Precipitation Expected at Colstrip During Various Time Intervals

Length of Event (hours)	Number of Years Considered 2	5	10	25	50	100
	Amount of Precipitation (Inches)					
1	0.7	0.9	1.2	1.3	1.5	1.7
6	1.0	1.3	1.6	2.0	2.2	2.4
24	1.4	2.0	2.4	3.0	3.4	3.8

of 8° F. July is the warmest with an average temperature of 72° F and an average maximum of 90° F. The potential growing season, based on the frost-free period 115 days, is effectively terminated during midsummer, when drought-induced dormancy of vegetation occurs (Toy and Munson, 1978).

Humidity

The average annual relative humidity varies around 60 percent. The relative humidity is highest in winter, lowest in summer, and varies widely, along with air temperature, between day and night.

Winds

Surface wind speed and direction are monitored by Western Energy from a meteorological station on a 10-meter tower inside the Area A train loop. (See fig. I-1.) A "wind rose," figure II-8, summarizes the distribution of surface winds for 1980. Southerly winds predominated. Strongest wind speeds were from the west-southwest, slowest wind speeds from the east. Calm conditions occurred 15 percent of the time. Wind speeds in excess of 13 miles per hour occurred about 10 percent of the time, and wind speeds in excess of 25 miles per hour occurred less than one percent of the time.

The regional EIS on the Northern Powder River Basin (U.S. Department of Interior and Montana Department of State Lands, 1980) and the previous EIS on Area E (Montana Department of State Lands, 1981) contain detailed analyses of the climate of Colstrip. Climatic conditions have important effects on reclamation and revegetation success and on air quality impacts.

AIR QUALITY

The air pollutant of concern at Colstrip is total suspended particulate (TSP). TSP concentrations are measured at 15 sites in the Colstrip area: 11 sites

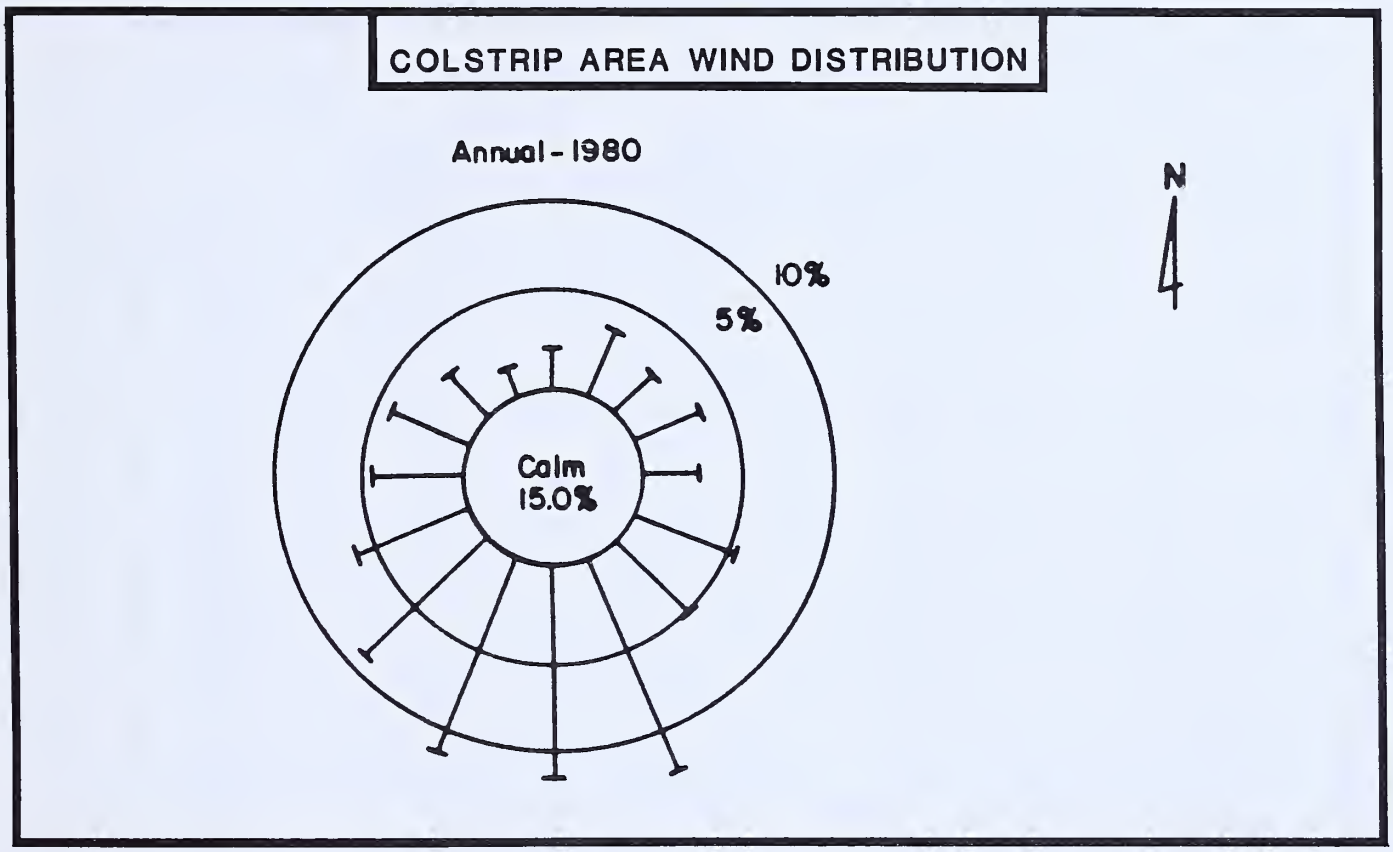

FIGURE II-8

Winds in Colstrip generally blow from the south. Winds from the north are rare. The wind rose shows annual wind distribution as a percentage of time.

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are maintained by Western Energy Company (fig. II-9) and four sites are maintained by Montana Power Company. The high volume air sampler monitoring results from these sites for the years 1982 and 1983 are shown in table II-8.

The highest TSP concentrations in 1982 and 1983 were measured at Western Energy sites 3, 4, and 6. These sites are located close to the Area A-B load-out facility. Coal dust particles generated at the mine are large and rapidly fall to the ground close to the source. Because these three monitors are located on a permitted area to which the public does not have free access, the Montana Ambient Air Quality Standards (MAAQS) do not apply.

The other 12 sampling sites recorded much lower TSP concentrations with annual arithmetic averages ranging from 16 to 80 $\mu g/m^3$. (For comparison, the annual arithmetic average TPS concentrations in Lame Deer and Busby were 28 $\mu g/m^3$ and 17 $\mu g/m^3$ in 1982.) During 1983 all 12 sites were in compliance with the annual average TSP MAAQS. The 24-hour TSP MAAQS was exceeded once at Western Energy site 2 and Montana Power site 3, and twice at Montana Power site 2 during 1983. However, the 24-hour standard of 200 $\mu g/m^3$ can be exceeded once per year according to the MAAQS. Thus only at Montana Power site 2 are the MAAQS considered to be exceeded.

The air quality of the Colstrip area has been discussed in greater detail in recent EISs (MDSL and U.S. Office of Surface Mining, 1982b; MDSL, 1981;

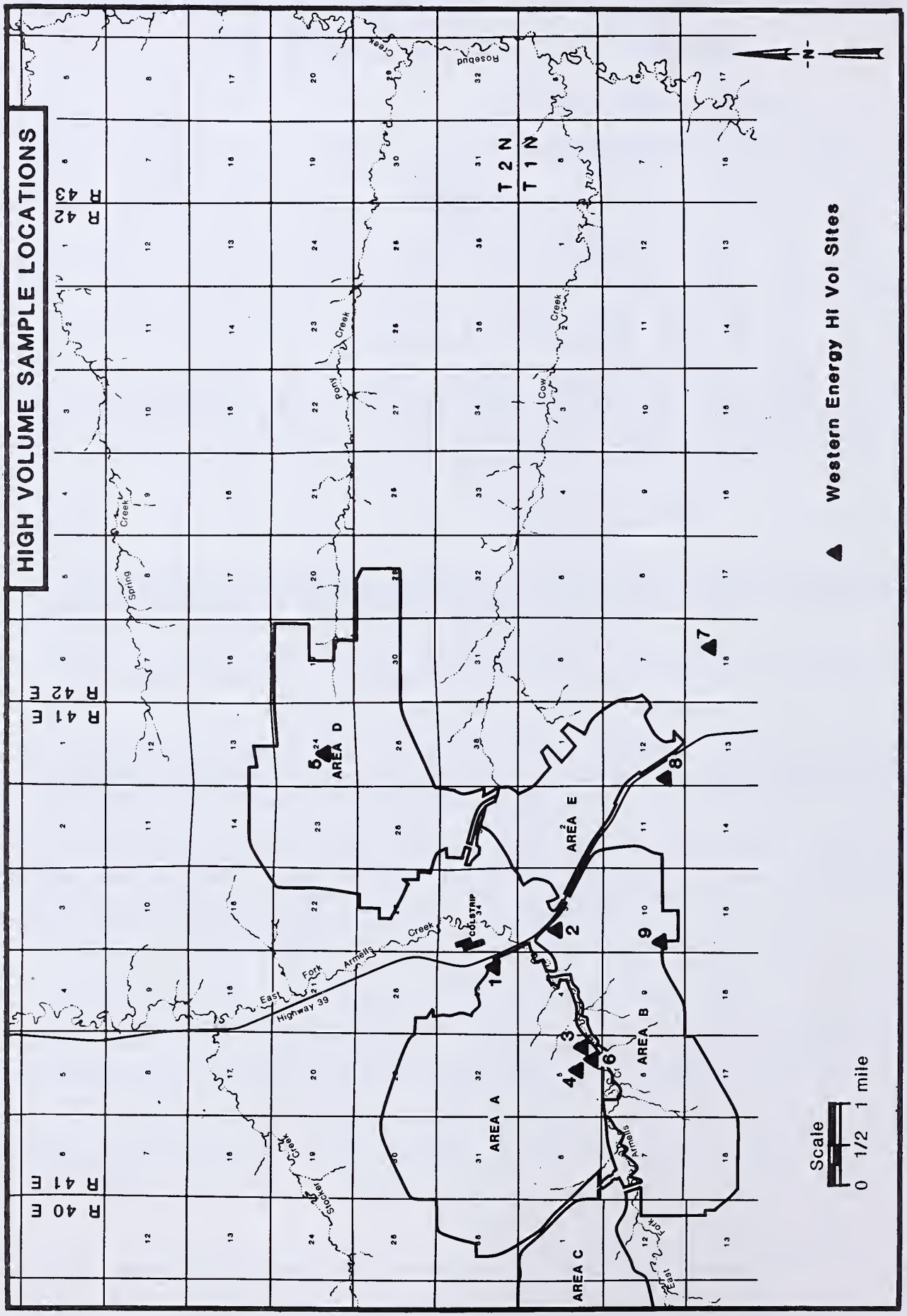

FIGURE II-9

Western Energy Company maintains 11 high-volume air sampler sites in the Colstrip area. Shown here are nine of the sites. The two remaining sites are located off the map to the west, on Area C.

TABLE II-8

Total Suspended Particulate Concentrations in the Colstrip Area for 1982 and 1983

Site	Year	Number of Samples	Annual Arithmetic Average	Highest 24-hour Concentration	Number of times exceeding 24-hour Standard
Western Energy					
1	1982	60	44	153	0
	1983	59	44	194	0
2	1982	59	80	422	4
	1983	56	47	340	1
3	1982	60	111	916	8
	1983	59	118	397	7
4	1982	61	162	1,007	14
	1983	53	149	1,228	12
5	1982	55	16	61	0
	1983	58	18	57	0
6	1982	61	95	535	8
	1983	60	100	428	6
7	1982	59	19	49	0
	1983	54	22	118	0
8	1982	59	23	65	0
	1983	60	22	78	0
9	1982	59	23	123	0
	1983	60	22	80	0
10	1982	60	19	100	0
	1983	58	23	94	0
11	1982	58	21	117	0
	1983	55	20	78	0
Montana Power Company					
1	1982	59	44	231	2
	1983	50	28	79	0
2	1982	59	29	95	0
	1983	54	52	497	1
3	1982	51	50	150	0
	1983	55	49	208	1
4	1982	56	51	145	0
	1983	56	39	133	0

Source: Computer records, Montana Department of Health and Environmental Sciences, Air Quality Bureau, 1984.

MDSL, 1980; and USDI and MDSL, 1980). The reader interested in further information is directed to these documents.

EMPLOYMENT AND INCOME

The Rosebud County economy has undergone a significant transformation during the past 15 years. Renewed coal mining at Colstrip started the area on the path of large-scale industrial development, which has displaced agriculture as the dominant economic activity in the county.

Renewed mining began in 1968, when Western Energy opened and expanded its Rosebud Coal Mine. The Peabody Coal Company then opened its Big Sky Mine about three miles south of Colstrip, and a consortium of five electric utilities led by the Montana Power Company established Colstrip Units 1, 2, 3, and 4, a 2,100-megawatt electric generating plant next to the Rosebud Mine. The Burlington Northern Railroad meanwhile expanded its Forsyth operations to accommodate increased coal shipments from Colstrip to midwestern electric utilities.

The result of industrial development was that, by 1980, employment in coal mining had reached 473 positions, ten times the number in 1970. Employment in the transportation and utility sectors reached 480 positions, three times the 1970 level (Regional Economic Information System [REIS], Annual).

Construction of the Colstrip generating complex began in 1971 with Units 1 and 2, two 350-megawatt plants. The county's construction work force, numbering less than 100 persons in 1970, rapidly expanded to a peak of 1,354 workers in 1975. After the completion of Units 1 and 2, construction employment fell to a low of 267 persons in 1978 (Montana Board of Crime Control [MBCC], 1983). In 1980, construction of Units 3 and 4 began and the construction work force again expanded, reaching a peak of 2,413 in 1982. The construction work force never reached its anticipated 1982 peak of 3,000 to 3,400 workers (Montana Department of State Lands [MDSL] and U.S. Office of Surface Mining [OSM], 1982b). Unit 3 was completed in the fall of 1983, starting a gradual decline in the number of construction workers needed at the project site.

Today, about 400 workers are building Unit 4. During 1983, Montana Power, the operator of the generating plant, added personnel to staff Unit 3 for commercial operation. About 620 utility employees now man Units 1, 2, and 3; Western Energy's Rosebud Mine has an operating crew of 332 (Ed Handle, Assistant Project Manager, Montana Power Company; Cliff Young, Manager, Sunlight Development Company; and Chris Cull, Manager of Operational Permitting, Western Energy Company; pers. comm., July 27, August 30, 1984).

In early 1984, the construction period for Unit 4 was extended by 9 months. The unit's turbine roll is set for December 1985 and commercial operation is scheduled to begin in April, 1986. The completion of Unit 4 will end

almost 15 years of continuous construction in the Colstrip area and the construction work force will decline by another 300 jobs during the period. It is anticipated that another 100 positions will be added to utility operations at the same time (Ed Handle, Montana Power Company, pers. comm., July 27, 1984).

During 1982 and 1983, coal consumption by midwestern utilities fell, owing to unseasonably warm winter weather and a national economic recession. The associated drop in coal sales led to some job cuts at the Rosebud Mine. Likewise, the completion of Unit 3 led to the gradual discharge of a large number of construction workers. In 1983, Rosebud County's unemployment level reached 8.8 percent (711 workers) and matched the state rate (Montana Department of Labor and Industry [MDLI], monthly). Historically, Rosebud County's unemployment rate has been significantly lower than the state average, at times by as much as 50 percent. (See appendix A, table A-2.)

The large increases in employment in the mining, utility, and construction industries throughout the 1970s spurred job creation in the local economy's support sector. Led by increases in the services industry, combined employment in the service, trade, finance, and real estate sectors nearly tripled between 1970 and 1982. At the same time, government employment, principally at the local level, rose from 301 to 657, a 118 percent increase.

During the same period, agricultural employment declined, as it has both in Rosebud County and Montana as a whole since the 1930s. Agriculture remains an important part of the county's economic base, accounting for 600 jobs, or roughly 10 percent of total employment.

As Rosebud County's employment pattern has changed, so too has the composition of total personal income. In 1970, total personal income equaled $16.7 million, or 0.7 percent of the state total, an amount less than proportionate with its share of the state's population (0.87 percent) that same year. In 1982, personal income had increased to $120.2 million, or 1.6 percent of the state total.

Labor and proprietor's income constitutes the largest share of income received by local residents (88 percent) and has grown faster than other sources of income, led by increases in the construction, mining, transportation, and utility industries. Per capita income also has greatly increased since the onset of industrial development. In 1970, per capita income was $2,768, compared with $9,879 in 1982. Rosebud County's per capita income level is 104 percent of the statewide average of $9,544 per person. (See appendix A, table A-1). Throughout the 1970s, fluctuations in the level of construction employment caused local income to vary more than elsewhere in the state. Agricultural income also rose and fell several times during the same period. In 1982, agricultural income totaled $4.1 million, or 3 percent of the county total (REIS, Annual). (See also appendix A, tables A-1 and A-2.)

SOCIAL CONDITIONS

Population

Rosebud County

In 1970, just after the onset of coal development, the population of Rosebud County was 6,032. In 1980, the U.S. Census reported a population of 9,899, a 64.1 percent increase. Population projections developed in 1981 by Mountain West Research, Inc. (MWRI), suggested that population growth associated with Units 3 and 4 had pushed the population total to 11,278 by the start of 1981. The Mountain West estimates reflect the employment and population buildup at Colstrip during the summer and fall of 1980, following completion of the census in April. Anticipated increases in construction employment during the early 1980s led to population forecasts exceeding 16,000 persons in 1982 and 1983. The expected employment levels never materialized, nor did the population forecast. A recent, retrospective population analysis conducted for the Montana Coal Board (Holtzmann Associates, 1984) measured the county population at 12,170 in 1982, increasing to 12,565 in 1983, and dropping back to 12,037 in 1984. (See appendix A, tables A-3 and A-4.)

With approximately 12,000 residents, Rosebud County's population density is 2.4 persons per square mile, 56 percent lower than the state of Montana as a whole (5.4 persons per square mile). Most of Rosebud County is populated by scattered ranch and farm families. Settlement is concentrated in a narrow six-mile-wide corridor along the Yellowstone River, at Colstrip, and in a belt along Highway 212 in the southern portion of the county on the Northern Cheyenne Indian Reservation.

The construction of generating Units 1, 2, 3, and 4 attracted a large number of young men to the area, a situation that is now being reversed as construction tapers off. In 1980, the average Rosebud County household had 3.06 persons, compared with 2.70 persons statewide. The large household size in the county is a reflection of larger than average families on the Northern Cheyenne Indian Reservation, which has an average household size of 3.45 persons. The county population also was younger than Montana as a whole, with a median age of 25.3 years, compared with 29.0 years statewide (U.S. Bureau of the Census, 1980).

Colstrip

In 1980, Colstrip's population was counted by the U.S. Census as 1,476. A separate population estimate developed for the Montco Mine EIS (MWRI, 1981) indicated a population of 3,750, or roughly seventeen times greater than 1970. Again, the employment and population build-up following the 1980 census accounts for the estimate of 3,750 residents. The community's population was expected to peak in 1982 near 8,000 residents, but that level was not achieved. Today, about 4,500 persons live in Colstrip (Holtzmann Associates, 1984).

Forsyth

In 1980, 3,054 people lived in the Forsyth area, including 2,533 people within the municipal limits. Today's population is estimated at 3,500, or 86.8 percent above the 1970 level (Montana Department of State Lands [MDSL], 1983).

Housing

Rosebud County

The total number of housing units in the county rose from 2,055 in 1970 to 3,787 in 1980, an 84.3 percent increase. Mobile homes accounted for almost 60 percent of all the new housing units created and now constitute almost 36 percent of the county's housing stock, compared with 12 percent statewide. The 1980 median value of all housing in the county was $42,400, compared with $46,500 in Montana as a whole. Owner-occupied units made up 67.6 percent of all housing, similar to the state as a whole.

Colstrip

Between 1970 and 1980, the Sunlight Development Company, a subsidiary of Montana Power Company, financed or constructed 960 housing units in Colstrip. The new units house both permanent employees for the mine and power plant and construction workers temporarily living in the community. By 1982, total housing stock (permanent and temporary) had risen to 2,309 dwellings, while 405 more dwellings were under construction (MDSL, 1983).

The completion of Unit 3 has greatly reduced the demand for housing and Sunlight Development has been selling mobile homes and having them moved from Colstrip. In mid-1984, a housing count conducted for the Montana Coal Board indicated 1,438 occupied houses and 90 occupied recreational vehicles (Holtzmann Associates, 1984). Historically, housing has been more expensive in Colstrip than Forsyth. In 1983, houses that cost $50,000 to $60,000 in Forsyth were generally $25,000 to $30,000 higher in Colstrip (MDSL, 1983). Used mobile homes are now widely available at favorable prices, but there is relatively little demand for them in the immediate Rosebud County area.

Forsyth

The 1980 Census in Forsyth counted 1,258 housing units, of which 1,242 were year-round. Twenty-three percent of the housing consisted of mobile homes and 62 percent of single-family detached dwellings. Forsyth's housing stock rapidly expanded during the 1970s, but did so in a more systematic manner, less subject to the rapid swings in demand caused by changing levels of construction employment.

Unlike Colstrip, Forsyth's new housing was created by a large number of private developers and individuals responding to the market demand for housing; Sunlight Development did not create housing in the Forsyth area. The demand for housing today is relatively stable. Rental vacancy rates will

probably increase somewhat as Unit 4 nears completion, and the number of temporary construction workers needing housing in the area decreases. When that happens, rents may drop or, at least, stabilize for a period until housing demand increases.

Social Life

A brief social history and description of social life of the Colstrip area is given in the final EIS on Rosebud Mine's Area C, Block 1 (MDSL and U.S. Office of Surface Mining, 1982b). A summary of the Area C EIS's findings follows. Only social life at Colstrip is examined here, since Colstrip is the most sensitive to changes at the Rosebud Mine.

Colstrip has periodically grown along with the expansion of the railroad and mining. It was not until the early 1970s that the population grew rapidly. This growth raised conflicts over land use, economics, politics, and values (Gold, 1974, 1975). Montana Power's ownership of the entire community and the high percentage of temporary jobs also contributed to such conflicts. Status differences and the arrangement of permanent and temporary housing limit social contact between different groups. The limitations do appear to be decreasing, however, and for all practical purposes, will disappear with the end of construction.

Much of the conflict that arose at the time of Colstrip's rapid development in the 1970s no longer exists. The emphasis has moved from opposing groups, one resisting development, the other supporting development, to individuals debating how to develop. During 1984, some controversy was created by questions regarding the construction materials and practices used to seal the fly ash ponds for Units 3 and 4, and a local rancher has challenged Western Energy Company's authority to extract coal without control of the surface rights.

There does not appear to be a distinctive Colstrip life style, but life in Colstrip is different from the remainder of Rosebud County. Feelings of isolation, higher salaries, and the lack of shopping and recreation in Colstrip, encourage residents to travel to nearby cities more often than other Rosebud County residents. Colstrip residents are reportedly apolitical and have little impact on county politics.

Family life is reported to be important in Colstrip, especially to permanent residents. The divorce rate for all of Rosebud County has actually been lower than the rate for Montana as a whole. Yet, during a quality-of-life survey conducted for the Area C EIS, two of the three most frequently mentioned social problems were divorce and family instability. The importance attached to family life may lead to greater concern over family-related social problems.

Through its recent history, Colstrip has been characterized as a "boom town" susceptible to a variety of pathological conditions ranging from crime and delinquency to alcohol and drug abuse. While such problems were frequently mentioned in surveys of local residents and social service personnel, the actual measurement of such phenomena revealed mixed circumstances. Along with

higher employment and population at Colstrip, Rosebud County did experience more criminal activity, but the actual amount of change has been modest. The county's rate of major felony crimes has never approached the state rate. For example, in 1982 at the peak of construction, Rosebud County's crime rate was 2,712.5 crimes per 100,000 population, well below the state rate of 4,306.5. Part 2 crime, the lesser felonies, rose and fell along with employment and exceeded the state norm during the two years when construction employment was the highest. County alcohol sales have always been high, generally well above the state average. During the past two years, as the level of construction activity increased, so did alcohol sales; statewide, alcohol sales fell (Montana Board of Crime Control, 1983).

The transformation of Rosebud County and the Colstrip area from an agrarian to industrial society is nearly completed. Barring further industrial development in the region during the next decade, Colstrip and its residents will become more fully and actively integrated into the social, political, and economic life of the county. In turn, the distinctions between groups that have characterized social life in the past will gradually fade.

SOCIAL AND COMMUNITY SERVICES

Law Enforcement

The Rosebud County Sheriff provides law enforcement in Colstrip. Six deputies, five dispatchers, and one dogcatcher are assigned to the Colstrip office. An additional deputy patrols the rural area between Colstrip and Ashland.

Law enforcement personnel and equipment are located in the Colstrip Community Service Center. Detention facilities comprise four cells, each with two bunks. The Colstrip Sheriff's office has three patrol cars and one pickup truck. Communications are provided by a low-frequency band radio system. The sheriff's office provides communications and dispatching service for the local emergency medical service and fire protection organizations. The sheriff considers his manpower and equipment adequate to serve the present population (Robert Ash, Rosebud County Sheriff; Cron Bromley, Rosebud County Deputy Sheriff, pers. comm., July 3 and September 4, 1984).

Fire Protection

A 22-member volunteer fire department provides fire protection for Colstrip and the area within five miles of town. The department also provides service by contract for Western Energy's property. Approximately 75 percent of the staff are trained firefighters. Water flows to hydrants in Colstrip are considered excellent now and for the foreseeable future. The fire department is equipped with five vehicles, including two 1,000-gallon-per-minute (gpm) pumpers, a 2,000-gallon tanker, a 1,500-gallon tanker, and an equipment van.

Equipment storage is provided in two garages. One is located at the Colstrip Community Service Center. The second facility, a two-stall garage,

is located near the Pine Butte School at the northern end of Colstrip. It was completed in late 1982. All fire department members are equipped with full turn-out gear and 24-hour pagers. The department is dispatched through the Rosebud County Sheriff's dispatch center in Colstrip. The Colstrip fire chief considers his department adequate to meet the fire protection needs of Colstrip for the present and the foreseeable future. Colstrip currently has a Class 7 rating, about average for a rural volunteer fire department (Dennis Dryer, Sec./Treas., Colstrip Fire Department, pers. comm. September 4, 1982).

Waste Water Treatment

The sanitary sewer system serving Colstrip is owned by Rosebud County and maintained by Sunlight Development Company. Treatment is accomplished in an oxidation ditch supplemented with an aerated lagoon installed in 1982. The lagoon serves as a holding pond. Two cells from an older lagoon system are used as sludge drying beds. The Montana Department of Health currently considers that the "operation of the plant and laboratory control are good" (Montana Department of Health and Environmental Sciences [MDHES], 1984). The effluent discharge is within or below permit limitations (Cliff Young, Manager; Lawrence Miller, Engineer, Sunlight Development Company, pers. comm., July 3, 1984).

Water Supply

Water for the town of Colstrip is drawn from the Yellowstone River and pumped approximately 30 miles to Colstrip and stored in Castle Rock Lake, a pond built to feed water to the Colstrip generating units. The treatment plant has a capacity of 4,000 gpm through a rapid sand filter. The water is treated with alum, chlorinated, and flows to a 350,000-gallon clearwell before being pumped to three distribution tanks totaling 1.65 million gallons. Water is distributed by gravity feed through mains ranging from 2 to 14 inches. The water system has adequate capacity for a town of Colstrip's size (MDHES, 1984; Cliff Young, Manager; Lawrence Miller, Engineer, Sunlight Development Company, pers. comm., July 3, 1984).

Solid Waste

Solid waste collection and disposal services are now provided by a rural refuse disposal district. The district contracts for refuse collection services with a waste disposal company headquartered in Miles City. Refuse collection is made by a truck with a 25-cubic-yard compactor. Solid wastes are buried in old strip-mine cuts sealed with clay northeast of the Colstrip townsite. Old mine spoil is graded over the solid wastes. The present dump site serves Rosebud and Treasure counties and the Northern Cheyenne Reservation. Solid waste collection capacity is adequate at present, with one collection day per week. The Montana Power Company's Environmental Department monitors four wells beside the landfill site for ground water contamination. There have been no problems to date (Lawrence Miller, Engineer, Sunlight Development Company; Julie Etchemendy, co-owner, Colstrip Disposal Service, pers. comm., July 3, 1984).

Social Welfare

Social welfare is a function of the state of Montana, administered locally through county government. The same services are available throughout Montana:

- Aid to Families with Dependent Children
- Food Stamps
- Medicaid and County Medical Assistance
- Foster Care
- General Assistance
- Child Welfare Services
- Social Services

The Rosebud County Welfare Department maintains three offices in the county at Forsyth, Colstrip, and Lame Deer. Only social services and child protection services are directly available from the Colstrip office. Determinations of eligibility for economic assistance are made through the Forsyth office. The Colstrip office is staffed by one social worker, a number sufficient for the current caseload (Mike Kennedy, Director, Rosebud County Welfare Office, pers. comm., July 6, 1984).

Medical Services

Outpatient medical services are provided by the Colstrip Medical Clinic, formerly a Southeastern Montana Rural Health Institute (SEMRHI) facility. The clinic was converted to private ownership in July, 1984, and is owned by the Garberson Clinic of Miles City. The facility is staffed by one full-time general practitioner, three part-time registered nurses, and a radiology technician. The Garberson Clinic rotates medical specialists through Colstrip. An opthalmologist, urologist, and orthopedic specialist visit the town one to four times per month, depending on need. The clinic currently has five examining rooms, an x-ray unit, laboratory, and emergency room. It is located in the Colstrip Mall (Heidi Kramer, Office Manager, Colstrip Medical Clinic, pers. comm., July 3, 1984).

The former Colstrip Dental Clinic is now owned and operated by Dr. Gregory Olson, D.M.D. It is staffed by a full-time dentist, a dental hygienist, two dental assistants, and a receptionist. The clinic will move to a new building in the fall of 1984 (Dr. Gregory W. Olson, dentist, pers. comm., July 3, 1984).

An optometric office is located in the Colstrip Mall, staffed by a physician based in Miles City who visits the office two days per week (Margaret Porter, Optometric Assistant, pers. comm., July 3, 1984).

The Eastern Montana Community Mental Health Center of Miles City administers mental health services for Colstrip. The Colstrip Mental Health Center, staffed by one psychologist, had 38 cases as of the end of July, 1984; it has capacity for additional cases (Duane Haidle, Colstrip Mental Health Center; Frank Lane, Eastern Montana Community Health Center, Miles City, Montana, pers. comm., July 3 and September 10, 1984).

There are four ambulances in Colstrip, two owned by Bechtel Energy Company and two by the Colstrip Emergency Medical Service. Helicopter and fixed-wing air ambulance service is available through Saint Vincent Hospital in Billings. The Emergency Medical Service is staffed by 11 volunteers. This emergency service is adequate for current needs (MDSL, 1983).

Rosebud Community Hospital and Nursing Home, 33 miles north in Forsyth, is the closest hospital to Colstrip. It has a staff of 63 full-time equivalent employees between the hospital and nursing home. The hospital has 20 licensed beds, maternity case, emergency facilities, an x-ray department, and a part-time pharmacy. During 1983, the hospital had a 27.7 percent occupancy rate (patient days/licensed beds x 365 x 100%).

Forsyth is also the closest city offering nursing home facilities to Colstrip residents. The Rosebud Community Nursing Home has 51 skilled-care beds with four more to be added in late 1984. The home had a 94 percent occupancy rate in 1983 (patient days/skilled beds + intermediate beds/days reporting x 100%) (MDHES, 1984; Yvonne Armstrong, Controller, Rosebud Community Hospital and Nursing Home, pers. comm., July 3, 1984).

Education

Colstrip School District No. 19 currently operates two elementary schools. In mid-September, 1984, the Isabelle Bills Elementary School's enrollment was 284 students. Class size ranged from 14 to 22 pupils and averaged 17.8. The Pine Butte Elementary School had an enrollment of 365 students. Class size ranged from 13 to 25 students and averaged 20.3. (See also appendix A, table A-5.)

Both elementary schools have large physical plants and space for more students. Using the minimum accreditation standard as a guide, the existing elementary school classroom configuration could accommodate up to 255 more students (Montana Board of Education, 1983). (See also appendix A, table A-5.)

The Colstrip Middle School is located in the old Colstrip High School near the center of town. Its enrollment is 292 students and the building has capacity for 350 pupils.

The Colstrip High School is a new facility completed in the fall of 1983. It was designed to accommodate 500 students. The 1984 enrollment is 429. The school has ample capacity for more students and the enrollment will level off, if not decline, following completion of Units 3 and 4 (Bill Medved, Counselor; Harold Tokerud, Superintendent of Schools, pers. comm., August 9, 1984).

FISCAL CONDITIONS

Property taxes are an important source of local government and school district revenue in Rosebud County. The taxable value associated with the gross proceeds (45 percent of the contract sales price of the coal) of the Western Energy and Peabody mines and with the Colstrip generating units has become the

major source of property taxes. State and federal impact assistance have also provided significant amounts of revenue to local governments and school districts in the county. (See appendix A, table A-6.)

Total mill levies in Rosebud County fell by 45 percent between fiscal year (FY) 1980 and FY 1985. Property taxes have provided an average of 33 percent of the county's revenue over the last six years (tables II-9 and II-10). The county has also maintained large cash balances during the same period. The general fund budget in Rosebud County increased by 65 percent between FY 1980 and FY 1985, while the total levied budget increased by 48 percent (table II-11). The general fund is the principal operating fund of a local government jurisdiction and the one most likely to change because of changing population levels. General fund revenues in the Colstrip school district are provided by property taxes paid in that district. In school districts without coal development, such as the elementary and high school districts in Forsyth, most general fund revenues come from the County Equalization Levy.

Table II-12 shows the taxable value in Rosebud County by property classification for FY 1980 to FY 1985. In FY 1985 the gross proceeds of the two coal mines in the county will provide about 17 percent of the county's taxable value; centrally assessed utility property and mining machinery will provide about 67 percent; oil production will provide 8 percent; and the balance will come from land and improvements, agriculture, and other personal property (Montana Department of Revenue, 1984).

Between 1978 and 1983, Western Energy paid $154 million in local, state, and federal taxes, not counting income and payroll taxes (table II-13).

Not all jurisdictions in Rosebud County have benefited equally from the increases in taxable value brought about by energy development. Between FY 1980 and FY 1984, taxable value in Rosebud county grew by 198 percent; in the

TABLE II-9

Mill Levies by Major Fund, Rosebud County, Fiscal Years 1980-1985

	General Fund	Road & Bridge Fund	Poor Fund	Other[1] Funds	Total All Funds
1984-85	4.99	5.55	1.10	2.19	13.83
1983-84	5.98	7.30	0.96	2.11	16.35
1982-83	0.00	12.73	2.27	2.76	17.76
1981-82	0.85	7.26	1.85	3.26	13.22
1980-81	2.03	7.92	2.40	3.12	15.47
1979-80	4.40	16.00	1.10	3.66	25.16

Source: Montana Tax Foundation, Annual.

[1]Includes fair, library, airport, cemetery, debt service, senior citizens, and museum funds.

TABLE II-10

Revenue Components by Source, Rosebud County, Fiscal Years 1980-1985

	Property Tax	Cash Balances	Fees Licenses Fines	Intergov. Transfers	Miscell.	Total	Other State Grants[1]	Other Federal Grants[2]
1984-85	$3,369,729	$3,763,683	$411,927	$778,968	$ 814,465	$9,138,722	$ 760,558	$ 924,005
1983-84	3,626,242	3,177,963	410,433	521,902	450,350	8,186,890	1,977,548	1,338,000
1982-83	2,882,392	3,334,234	651,102	134,965	1,443,750	8,446,433	1,856,599	405,205
1981-82	1,552,699	3,216,272	NA	NA	NA	6,485,623	3,121,050	671,223
1980-81	1,652,259	3,361,275	NA	NA	NA	6,737,219	55,538	377,242
1979-80	1,824,210	2,930,572	NA	NA	NA	6,074,928	266,971	712,715

Source: Rosebud County Budget, Annual.

[1]Includes coal grants, junk vehicle, alcohol, crime control, and land planning.

[2]Includes revenue sharing, payment-in-lieu of taxes, and Bureau of Reclamation grants.

Note: NA = Not available.

TABLE II-11

Total Budget by Major Fund, Rosebud County, Fiscal Years 1980-1985

	General Fund	Road & Bridge Fund	Poor Fund	Other[1] Funds	Total All Funds
1984-85	$4,622,249	$2,712,905	$583,666	$1,219,902	$9,138,722
1983-84	3,731,497	2,983,072	563,379	908,301	8,186,249
1982-83	3,332,874	2,959,555	604,840	842,706	7,739,975
1981-82	3,093,975	2,194,313	469,450	699,709	7,157,156
1980-81	3,033,770	2,550,707	406,486	714,334	6,705,297
1979-80	2,802,922	2,467,027	231,118	661,489	6,162,556

Source: Montana Tax Foundation, Annual.

[1]Includes fair, library, airport, cemetery, debt service, senior citizens, and museum funds.

town of Forsyth, the increase was only 1.3 percent (Montana Tax Foundation, Annual). The changes and consequent disparity in the tax base were reflected in the mill levy, or tax rate. The Rosebud County mill levy decreased by 3.5 percent between FY 1980 and FY 1984. The Forsyth levy increased by 37 percent in the same period.

School districts were similarly affected. Property taxes in the Colstrip school districts were relatively low in FY 1980, totalling 67 mills, compared to 139 mills in Forsyth and 134 mills in similar-sized school districts elsewhere in the state. In FY 1984 the Colstrip school levy was 79 mills, compared to 117 mills in Forsyth and 142 mills elsewhere (Montana Tax Foundation, Annual).

LAND USE

The land in the Area D application area totals 3,073 acres, of which 1,708 will be mined and 907 disturbed by mine-related activities. Most of the area to be disturbed is rangeland (68.7 percent) and old mine spoil. Cropland (hay meadows and winter wheat) accounts for 120 acres, or 3.9 percent of the total permit area. The life-of-mine expansion totals 1,309 acres, of which 850 would be disturbed by mining and related activities. Of the total in the life-of-mine expansion, 1,234 acres are rangeland, 15 acres are cropland, and 60 acres are either disturbed grasslands, mine spoil, or ponds.

The proposed mine area has relatively low productivity with an average of 0.35 cow-calf units per month per acre during the early 1980s. As such, it would require 2.94 acres of grassland to support a single cow/calf unit for a month or 26.5 acres to provide feed through a 9-month grazing cycle. The total amount of grazing land that would be disturbed in the application area will support 80 cow/calf units per year. The life-of-mine expansion will probably support an additional 30 cow-calf units per year. (See Vegetation.)

TABLE II-12

Taxable Valuation by Property Classification, Rosebud County, Fiscal Years 1980-85.

	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85[1]
Land and improvements	$ 5,819,025	$ 8,051,338	$ 15,370,229	$ 6,761,118	$ 7,406,887	$ 8,083,623
Centrally assessed allocations	2,479,148	21,797,735	28,808,962	84,997,799	137,217,189	158,926,211
Net proceeds and royalties	14,261,451	14,437,660	13,528,472	22,797,065	26,425,258	19,720,916
Gross proceeds--mines	21,532,733	28,822,118	30,841,075	38,340,683	38,886,164	41,584,119
Other	30,685,973	30,168,165	32,659,484	10,742,813	12,681,666	16,049,944
Total taxable valuation	$74,778,330	$103,277,016	$121,208,222	$163,639,478	$222,617,164	$244,364,813

Source: Montana Department of Revenue, Annual.

[1]Preliminary estimates.

TABLE II-13

Western Energy Tax Summary, 1978-1983

Year*	Gross Proceeds Property Tax	Physical Plant Property Tax	Severance Tax	Resource Indemnity Trust Tax	Federal Abandoned Mines Reclamation	Federal Black Lung Excise Tax
1978	$ 1,331,591	$ 405,387	$ 10,673,472	$ 103,674	$ 3,571,036	$ 793,752
1979	1,687,710	423,608	13,756,352	127,889	3,912,979	1,433,333
1980	2,123,617	495,437	15,566,965	185,561	3,794,642	1,467,137
1981	2,762,486	627,697	18,507,106	196,076	3,625,684	1,786,990
1982	3,008,557	589,995	20,123,404	236,344	3,306,308	3,764,767
1983	3,050,499	528,405	21,894,316	239,226	3,350,784	4,096,468
Total	$13,964,460	$3,070,529	$100,521,615	$1,088,770	$21,561,433	$13,342,446

Source: Montana Department of Revenue, Annual.
Rosebud County Treasurer, Annual.
Western Energy Company, Annual.
*Calendar year the tax was paid.

In 1983, there were 81,900 cattle in Rosebud County. That same year, the county produced 1,495,600 bushels of winter wheat and 77,200 tons of hay. Cropland yields from the Area D site at present are approximately 2,112 bushels of wheat and 56 tons of hay, or 0.141 percent of the county's wheat production and 0.073 percent of its hay yield (Western Energy Company; Randy Van Winkle, Statistician, Montana Crop and Livestock Reporting Service, pers. comm., August 30, 1984).

There is one ranch headquarters in the Area D site that would be removed by mining. No other commercial structures or utilities are within the area.

TRANSPORTATION

Rosebud County's transportation network is made up of secondary, primary, and interstate highways, a railroad, and a county-owned and operated airport east of Forsyth. Federal Aid Primary (FAP) 39 connects Colstrip to Interstate 94 to the north and to FAP 37 (US 212) to the south.

Coal mined from the Rosebud Mine is shipped on the Burlington Northern Railroad spur to the main line north of Colstrip and then east to its final destinations. An average of three (a maximum of seven) loaded coal trains per day leave Colstrip. Most trains are loaded from the Areas A and B loadout facility; some are loaded from the Area E facility.

A grade separation (highway overpass) has been built in Colstrip, carrying the highway over the rail access to Areas A and B. No grade separation is planned for the railroad crossing south of Colstrip (the access to the Big Sky Mine). A large section of FAP 39 was reconstructed in 1983.

Between 1980 and 1983, FAP 39 had an average daily vehicle count of 1,509. The peak traffic volume was reached in 1982, with 1,750 cars per day. Since January, 1984, traffic between Forsyth and Colstrip has declined 29 percent, to 1,214 cars per day (Montana Department of Highways, Annual).

RECREATION

Outdoor recreation facilities in Colstrip include a 51-acre park system, a swimming pool, a wading pool, three tennis courts, three basketball courts, and five playgrounds for young children. Colstrip's new outdoor recreation complex, Stillwater Park, includes a baseball and two softball fields, a soccer field, an outdoor basketball court, and a playground area. Indoor facilities are provided at the Colstrip Community Center, which comprises 16,000 square feet of space that include two handball/racquetball courts, a weight/exercise room, a basketball court, and a meeting room.

Public recreation areas outside of the town of Colstrip are limited. Facilities include a motocross course and rodeo grounds, the Rosebud State Park

near Forsyth (picnic sites, fishing, boating), Castle Rock Lake (the 152-acre Montana Power water supply pond), 95,827 acres of Custer National Forest lands, and 230,000 acres of public land managed by the Bureau of Land Management. In addition, the Yellowstone and Tongue Rivers, as well as the Tongue River Reservoir in Big Horn County, provide boating, fishing, and bird watching.

The major recreation values of the public lands in the county are isolation, diverse topography, scenery, and big game. Hunting is the primary use. Other popular activities include picnicking and fishing. Outdoor recreation use of the lands and facilities outside Colstrip is not now approaching capacity (Montana Department of State Lands, 1983a).

CULTURAL RESOURCES

According to reports by Dale Herbort (1981, 1982), 44 cultural properties were recorded or revisited during cultural resource surveys of the application area and the one-mile buffer zone (table II-14). One prehistoric site known as Powers Quarry, 24RB478, was determined eligible for inclusion in the National Register of Historic Places. This site, in the application area buffer zone, is a lithic scatter (collection of manmade stone flakes and/or tools) of indeterminable age. Although the site has yielded neither features nor finished tools, its eligibility is based on the density of surface materials and its potential to provide information on lithic manufacturing techniques for this region. The site was salvaged during the summer of 1983 because of disturbance and vandalism related to its proximity to a nearby subdivision.

Herbort (1984) recorded 22 additional cultural sites within the life-of-mine expansion and one-mile buffer zone (table II-14). Six sites within this area are potentially eligible for nomination to the National Register. However, further testing is necessary on these sites before a final

TABLE II-14

Area D Cultural Resources

Location	Type of Site	
	Prehistoric	Historic
Application area	32	1
Application area buffer zone	5	6
Life-of-mine expansion	18	1
Life-of-mine buffer zone	5*	5*
TOTAL	60	13

*Two sandstone outcrops and five potential historic sites in this buffer zone have been surveyed.

determination of eligibility can be made. Five of these sites are prehistoric and may provide information about the prehistory of the region. The remaining site is a historic site and is in good condition. It may be a representative example of a 1930's homestead.

Due to access restrictions, most of the buffer zone of the eastern life-of-mine expansion has not been surveyed on foot. Through examination of existing records and aerial photos, an additional five historic sites and two sandstone outcrops (possible areas for rock art) were located. All sites, recorded and unrecorded within the eastern buffer zone are of undetermined eligibility for the National Register.

AESTHETICS

A variety of landscapes lie within Area D. Rolling hills with patches of ponderosa pine dominate the northern and eastern parts of the minesite. Three landscapes--rolling treeless rangeland, mine spoil from previous strip mining, and cropland--dominate the southern parts of the minesite.

The topography also varies. The southern part of the minesite slopes gently; the northern and eastern parts roll abruptly from rounded benchlands to shallow drainages. The highest hills rise 300 feet above the drainages. Scattered throughout the minesite are broken rock outcrops and rock ledges. The sharpest ledges are those bordering the pit left from previous mining.

The colors of the minesite reflect the vegetation, soils, and bedrock. Dominant are the dark green ponderosa pines. Irregular bands and clusters of pine woodlands grow mostly in the northern and eastern parts of the minesite. The pine contrasts with the brown or light green grasslands that are punctuated with yucca, sagebrush, juniper, rose, and other bushes. Where exposed, the soil is a dull tan, red, or brown. The rock outcrops are usually tan, sometimes red.

In the center of Area D is one ranch house surrounded with outbuildings, corrals and farm machinery. At the eastern end of the minesite is an abandoned log cabin. These structures are typical of this part of the West and blend with the surrounding landscape.

Just outside the boundary of Area D is Colstrip and the remainder of the Rosebud Mine, both of which contrast sharply with the undisturbed landscape. Most prominent are the four power plants (Colstrip Generating Units 1, 2, 3, and 4), their stacks, and the surrounding cooling towers, transmission lines, and coal-conveying and storage facilities. Also prominent are the draglines, spoil ridges, and mine facilities for the rest of the mine (Areas A, B, C, and E) and the housing development built to support the entire industrial complex.

The landscape of Area D is common in the plains region on the eastern side of the Rocky Mountains in Montana. Some nearby areas are less scenic--the flat agricultural lands between the Bull Mountains and the Yellowstone River. But many areas are more scenic--the Little Wolf Mountains, Big Horn Mountains, Yellowstone River, and the Bighorn Canyon and River. The more

scenic terrain offers denser vegetation, rougher topography, and more varied colors. Area D has pleasant scenery, but contains no unusual or distinctive aesthetic features.

The minesite is closed to the public. The only people using the area for its scenic quality would be those whose homes look out over it. This now includes the people living in about 150 houses in two developments just west of the minesite boundary.

Chapter III

IMPACTS OF WESTERN ENERGY'S PROPOSAL

This chapter covers 18 topics, presenting subject by subject the impacts--mostly unavoidable--that could be caused by the application and life-of-mine plans. At the start of each topic is a summary of the major impacts anticipated to be caused by the mine plans. Following the summary is a detailed discussion of the impacts. Each section ends, when appropriate, with a list of "mitigating measures," or actions that could be taken to reduce or eliminate the mine's projected adverse impacts.

GEOLOGY

Summary of Impacts: Impacts on Area D geology would not be significant. The postmining topography would approximate the existing topography, but would be gentler, with lower hilltops and broader drainage bottoms. With successful revegetation of the disturbed area, erosion rates would be similar to, or less than, premining rates. Minor ephemeral tributaries not restored during reclamation may redevelop as gullies. This would not affect postmining land use and would not release a significant amount of sediment downstream.

Overburden physical and chemical characteristics are not expected to adversely affect postmining revegetation success.

Topography and Geomorphology

The postmining topography of Area D would resemble today's unmined landscape (figs. I-6 and I-7). The reclaimed topography would be gentler, with lower hilltops and broader drainage bottoms. Maximum elevations would drop from about 3,570 feet to 3,520 feet. The elevation at any given location may increase or decrease by as much as 75 feet. On average, the reclaimed surface within the application area would be less than one foot lower in elevation than the premining surface.

Along the southern and eastern boundaries of the mine area, boxcut spoil would be permanently placed outside the Area D pit. Some of this material would be used to fill old Northern Pacific mine pits, and the remainder would be placed on adjacent undisturbed areas. Boxcut spoil would first be graded to blend with the surrounding landscape and most would then be topsoiled and revegetated. Approximately 370 acres of old Northern Pacific mine spoil located in sections 26 and 27, T2N, R41E, would be graded and reclaimed as part of the proposed mining activities. These spoil areas would not be topsoiled prior to revegetation.

To blend the regraded topography of Area D with the surrounding unmined topography, Western Energy Company would move some of the undisturbed overburden into the final mine pit--a process called highwall reduction. Highwall reduction areas are located along the western, northern, and eastern boundaries of the application area.

The proposed postmining drainage network would approximate the premining network. All large, ephemeral drainages would be reconstructed (fig. I-7) with slopes and positions similar to those of existing drainages. Drainage divides would shift a few hundred feet to the south, and any bedrock would be removed. Since bedrock restricts downcutting, the reconstructed drainages in places would be more susceptible to gullying than the premining drainages. To help control channel erosion, sandy soils would not be used along drainage bottoms and some drainage bottoms would be sodded.

The postmining drainage pattern would have a lower overall drainage density than the current pattern. Several of the shorter (less than 1,200 feet long) ephemeral drainages would not be reconstructed. If the reclaimed surface provides sufficient runoff, minor tributary channels flowing into the reconstructed drainage system could develop naturally over time. Formation of these additional drainages would probably occur as gullying. Gullying would probably be minor and would probably not limit land use or release large amounts of sediment. Channel formation would be initiated during periods of high runoff, when the entire basin would be contributing large amounts of sediment and runoff, thus masking any increased contribution from Area D. During the decade following reclamation, when the reclaimed surface is most susceptible to erosion, Western Energy would provide erosion and sediment control.

The average slope of the postmining topography would be 13 percent, compared to a 17-percent average slope for the premining topography. The steepest hillslopes, both pre- and postmining, occur in the northern part of the mine area.

In the northernmost part of the application area (Spring Creek drainage), erosion rates on reclaimed hillslopes would decrease. (The relative erodibility of selected hillslopes on the reclaimed surface was compared to similar premining hillslopes using the Universal Soil Loss Equation. See Technical Support Document on file at the Department of State Lands.) The decrease would result from a reduction in the relief, which decreases slope steepness, and from a change in vegetation from a mature ponderosa pine-grassland community to a reclaimed and developing ponderosa pine-grassland community. The increase in understory grasses in the developing ponderosa pine-grassland reclamation area would provide greater ground cover and thus greater erosion protection. In the southern part of the mine area, pre- and postmining hillslopes would have similar erosion rates (assuming both the pre- and postmining communities are grassland).

Erosion rates on newly reclaimed surfaces (graded, topsoiled, and mulched, but not revegetated) would be much higher than natural erosion rates. At this stage of reclamation, all runoff would be controlled by the runoff and sediment control system. As the new vegetation becomes established, erosion rates would decrease. Before bond could be released, vegetation on the reclaimed surface would have to provide erosion protection equal to or greater than that provided by vegetation on the area prior to mining.

Valley bottoms would have broader and flatter postmining cross sections, which would reduce peak flows and slow runoff. Nickpoints in the natural drainages would be removed by channel reconstruction. (Nickpoints are points of abrupt changes in channel gradient.) The drainages' snow-trapping capabilities would be reduced because of the channel form and topographic relief changes.

Highwall reduction areas elsewhere in the Rosebud Mine have been susceptible to gully and piping erosion (MDSL and OSM, 1982, p. III-1). Localized subsidence and differential settlement have, in part, been responsible. In Area D, areas of highwall reduction may also experience gully and piping erosion and differential settlement. Subsidence usually stops within three years after initial reclamation (MDSL and OSM, 1982, p. III-4). Since Area D encompasses the upper watersheds of affected drainages, erosion resulting from gullying or piping would be limited to the minesite.

The company would be responsible for erosion and sediment control at the minesite. Rilling and gullying deeper than nine inches would be filled and revegetated before bond release. Over the long term, gullies may develop on the reclaimed surface just as gullies develop in unmined areas. Ephemeral drainages in semiarid regions are susceptible to periods of gully erosion (Schumm and Hadley, 1957). Although gullying can be caused by land use practices such as overgrazing, gullying also occurs without man's influence. Gullies that do form on the reclaimed surface probably would not affect postmining land use; a few small gullies would not limit access or produce significant quantities of sediment.

Sediment ponds would prevent excess sediment from leaving the mine area during mining and reclamation. The ponds would allow sediment to settle out prior to discharge. As a result, the amount of sediment reaching receiving streams (East Fork Armells Creek, Spring Creek, Pony Creek, and Cow Creek) during mining operations would be less than before mining. Because of the small amounts of water and runoff involved, the infrequency of flow events in the mine area, and the temporary nature of most of the sediment control ponds, changes in the channel characteristics of receiving streams are not expected.

A subsidence monitoring study would be conducted in Area D. The program would be similar to the one now used in Area A. The monitoring data, showing accurate elevation readings across the reclaimed areas over time, would be submitted to the Montana Department of State Lands each year. DSL would review the data and determine what, if anything, would need to be done in response to subsidence or differential settlement.

Stratigraphy

The Rosebud coal seam would be removed by mining and the Rosebud overburden (spoil) placed back into the mined-out pit. The overburden strata have no unique or intrinsic value.

Overburden

Excavation would change the overburden in two fundamental ways. Blasting and removal would eliminate the bedrock and produce unconsolidated spoil, which would occupy more space than the original bedrock due to increased bulk porosity. This overburden swell would, in large part, compensate for the void produced by coal removal. Dragline mixing of the overburden layers would eliminate bedrock layering and thus reduce the heterogeneity of the overburden material.

If mining occurs, disruption of the overburden strata would be inevitable. As a result, three potentially adverse environmental effects could occur: First, ground water quality could be degraded and ground water flow could be decreased. The hydrologic effects are discussed elsewhere in this chapter. (See Hydrology.) Second, the productivity of reestablished vegetation could be less than existing vegetative productivity. This would result from the reconstruction of the rootzone from spoil materials having inferior properties as plant growth media relative to existing substrata. Third, plants or livestock could be exposed to toxic materials. This would stem from placing spoil materials having elevated concentrations of trace elements, chiefly boron and molybdenum, near the reclaimed surface.

Montana rules require that the upper 8 feet of regraded spoil be a suitable plant growth medium (ARM 26.4.506). Results of the premining overburden sampling program indicate that enough suitable spoil material would be available to meet this requirement. However, the overburden infrequently contains some materials having unsuitable physical or chemical characteristics. Some of these unsuitable materials could inadvertently be placed within the upper 8 feet of regraded spoil. A program of sampling regraded spoil, as proposed by Western Energy, would detect most areas containing problem materials. Additional grading or special handling of spoil materials would be undertaken in these areas to assure compliance.

Based on the results of the premining overburden sampling program, the overburden characteristic of most widespread concern is texture, due primarily to an abundance of sandy overburden materials. A small number of sample locations exhibit a predominance of clayey textures. Over most of the area to be disturbed, mixing from overburden removal and redeposition would probably ameliorate most textural problems. Without selective handling, however, coarse-textured (sandy) overburden would be placed in the upper 8 feet of regraded spoil in some areas. In the rootzone, these materials could hamper the survival, density or vigor of reestablished vegetation, due to lower water-holding capacity. This effect, however, is not expected to be significant, because most of the proposed reclamation plant species are native and generally adapted to growth in sandy media and under droughty conditions. This situation does not constitute a significant change from premining conditions.

At one sampling location, the overburden profile exhibited elevated salinity and boron levels. High salinity could cause moisture stress for growing plants. High boron could cause plant toxicity. Another nearby sampling location exhibited zones high in molybdenum. Plants grown in materials high in molybdenum can have high molybdenum concentrations compared to copper, rendering the plants toxic to livestock.

In the vicinity of these sample locations, monitoring of regraded spoil and selective handling of materials, including possibly the importation of higher quality spoil from other areas, may be necessary to avoid potential problems. These measures have been proposed by Western Energy, although the company has specifically identified only one of the sample locations of concern.

The overburden sampling intensity in the life-of-mine expansion is lower than in the application area. Additional sampling would significantly increase the reliability of overburden information in the expansion. Proposed routine monitoring of regraded spoil, which would be conducted prior to topsoil replacement, would minimize the potential for harmful effects.

Geologic Hazards

Explosive discharges used to fracture overburden and coal would be monitored and would not exceed 1 inch per second maximum potential velocity at the nearest dwelling two miles away. As such, mining and blasting would probably not structurally damage buildings or trigger earthquakes.

Geologic Resources

Sixty-nine million tons of coal in the Rosebud coal seam are estimated to be within the bounds of the application area. The life-of-mine expansion contains an additional 19 million tons of recoverable coal. Western Energy estimates that 94 percent of the coal would be recovered. It is extremely unlikely that the underlying McKay coal seam would ever be mined once the overlying Rosebud is removed. Additional coal seams lie farther below the surface, but are not economically mineable.

Mitigating Measures

Overburden sampling intensity in the life-of-mine expansion does not adequately characterize the overburden quality. Additional sampling would significantly increase the reliability of overburden information used to identify potential revegetation problems. To assure that postmining revegetation would not be adversely affected, additional overburden samples from the life-of-mine expansion should be collected and analyzed.

HYDROLOGY

Summary of Impacts: Mining in the application area would dewater the Rosebud coal aquifer by intercepting ground water now discharging to the upper Cow Creek watershed. Dewatering could reduce alluvial aquifer flow by 1.5 to 3.0 percent. Mining would also remove five wells and three seeps in the application area and possibly reduce flows and water quality in three nearby springs, two

adjacent to the application area and one beside the life-of-mine expansion. After mining, Western Energy would drill three sub-McKay wells to replace the wells and one of the potentially affected adjacent springs.

A spoil aquifer would develop with an anticipated total dissolved solids (TDS) concentration two to three times the concentrations now in the Rosebud coal and overburden. Spoil water would discharge to upper Cow and Pony creeks. Reclamation of unreclaimed Northern Pacific spoil next to Area D would decrease the total volume of spoil water discharging to Cow Creek. The result of increased TDS concentrations and decreased volume would be an increase in TDS concentrations in Cow Creek alluvial water by 1 to 2 percent from mining in the application area and 2 to 3 percent from mining in the life-of-mine expansion. Impacts overall would not be significant.

Ground Water--Changes During Mining

Mining would remove the Rosebud coal aquifer in Area D and would disrupt overlying water-bearing zones in the overburden. Initially, ground water from adjacent, as yet undisturbed, strata would flow into the mine pit. Dewatering effects would be limited to the mine area and the immediate vicinity because the Rosebud coal and overburden are topographically isolated.

The first cut (boxcut) for the proposed mining operation would be located along the southern boundary of the mine area, on the down-dip edge of the strata to be disturbed by mining. (The coal beds tilt slightly to the south toward Cow Creek.) Mine pit inflows would increase as the boxcut is extended. Maximum inflows would occur when the advancing mine pit first intersects the maximum width of an affected aquifer. In the application area, maximum inflows to the boxcut from the adjacent Rosebud coal aquifer are projected to be approximately 80 gallons per minute (gpm). Within a year after mining starts, mine inflows would drop to 35 gpm. Most or all of this inflow would be lost to evaporation.

Inflows from the adjacent old Northern Pacific spoil and spoil pond are more difficult to predict because of the uncertainty in aquifer characteristics and pond depths, and the limited lateral extent of the spoil aquifer. If the company leaves a strip of undisturbed Rosebud coal between the old spoil area and the mine pit, maximum inflows would be less than a few hundred gallons per minute. Should the mine pit instead intersect the spoil area, significantly greater inflows may occur as the spoil aquifer and spoil pond dewater into the mine pit. In either case, pit inflows would decrease rapidly as the pond and spoil aquifer are dewatered.

As mining continues, succeeding mine cuts would be located up-dip of the boxcut and would affect the same strata dewatered by the initial cut. The spoil aquifer would eventually stop contributing inflow to the pit. This would happen when the aquifer is totally dewatered or as succeeding cuts move up-dip away from the old spoil area. Inflow rates from the Rosebud coal would drop to less than 5 gpm as ground water storage in the aquifer is depleted.

Little information is available about the occurrence of ground water in clinker areas next to Area D. The clinker is believed to be largely unsaturated, and as such little inflow is anticipated from the adjacent Rosebud clinker areas. Minor additional inflows may occasionally occur as saturated zones in the overburden are intersected and dewatered by the mine pit.

Existing hydraulic gradients indicate a potential for downward flow from the Rosebud coal seam toward the McKay coal seam. Mining operations would remove the Rosebud aquifer, creating the potential for upward flow from the McKay coal seam. Over most of the Area D mine area the Rosebud-McKay interburden is sufficiently thick and low in permeability to limit inflow into the mine pit. An exception is the southwestern portions of the application area (between Area E and the old Northern Pacific spoil), where the interburden is less than 10 feet thick and may be sandy. In this area, the potential exists for upward flow from the McKay coal seam to the mine pit floor. The amount of upward flow would be limited by the small gradients involved and the relatively low vertical hydraulic conductivity of the interburden. Upward flow would not significantly reduce water levels in the underlying McKay coal seam. Vertically downward gradients would reestablish after pit backfilling with the formation of a spoil aquifer at the base of the mine pit.

Significant alluvial aquifers have not been identified in the application area or life-of-mine expansion. However, discharge of the Rosebud coal seam to Pony Creek may support a limited amount of saturated alluvium in the vicinity of spring No. 24 and upstream (fig. II-3). An alluvial monitoring well located on Pony Creek near the eastern boundary of the application area shows approximately one foot of saturated alluvium. Approximately one mile downstream of the alluvial monitoring well, the Pony Creek alluvial deposits are extremely thin (less than one foot in depth) and are unsaturated. This limited area of saturated alluvium would be dewatered as mining activities dewater the Rosebud coal seam. In addition, some recharge areas feeding this spring probably would be covered by boxcut spoil placed outside the mine pit area during life-of-mine operations, causing some flow reductions in spring No. 24.

The application area and life-of-mine expansion contribute such a small amount to the alluvial systems of Cow and Spring creeks that mining-induced changes would be insignificant. At present, the Rosebud coal in the application area discharges approximately 3 gpm to the upper Cow Creek drainage. This water may be temporarily interrupted by mining. Assuming that all Rosebud coal discharge contributes to the alluvial aquifer in Cow Creek, the 3 gpm loss represents only a 1.6 to 2.6 percent reduction in the alluvial ground water flow (120-200 gpm) on Cow Creek in section 36, T2N, R42E. Likewise, very small flow changes are predicted for Spring Creek alluvium.

Water entering the boxcut would be contained in the pit unless it becomes an operational problem, at which time it would be pumped to sedimentation ponds. Pond water would mainly be lost to evaporation, seepage, or used to water mine roads. The remainder would be discharged in accordance with Montana Water Quality Bureau (MPDES) regulations.

Five wells and three seeps (fig. II-3) in the application area would be removed by mining. One well (No. 69) is used for livestock watering; one, No. 70, is used for domestic water; and the other three (No. 71, No. 72, and No. 113) are unused. The three overburden seeps (Nos. 39, 40, and 41) seasonally provide small amounts of water for livestock and wildlife within the central part of the Area D application area. Since mining would remove overburden and would replace it with relatively homogeneous mine spoil, overburden seeps would probably not reform within the area mined following reclamation.

Other wells and springs are located in areas next to the Area D application area and life-of-mine expansion (fig. II-3). Some of the adjacent springs would also be affected by mining in the application area. McKay coal spring No. 23 in the Spring Creek drainage may experience decreased flow and be of worse water quality as a result of surface disturbances (highwall reduction or placement of spoil adjacent to the mine pit) in section 14 (T2N, R41E). This spring discharges at a minimum about 2 gpm and is used by livestock and some wildlife species.

Rosebud coal spring No. 24 located east of the Area D application area in Pony Creek may have lower flows and poorer quality water as a result of dewatering of the Rosebud coal aquifer by mining. Flows would be further diminished by mining in the southeastern portions of the life-of-mine expansion. Western Energy Company estimates a 6 percent loss in flow from activities in the application area. However, due to the uncertainty in projecting effects to springs, the decrease in flow could be considerably greater. Flow from spring No. 24 collects in a pond a short distance downstream of the spring and is used by livestock and probably by wildlife.

Rosebud coal spring No. 26 (fig. II-3) is located adjacent to the southeastern portion of the life-of-mine expansion. Flow from this spring may also diminish as the life-of-mine operations dewater the adjacent Rosebud coal aquifer. Spring No. 26 is used for stock watering.

Other springs farther away from the mine are developed in the McKay coal and sub-McKay aquifers and would be unaffected by mining. Wells located in the Spring Creek and Cow Creek drainages (fig. II-3) are completed in the sub-McKay aquifer and would not be affected by mining.

During reclamation, two new wells would be constructed to replace the two wells currently used in the application area. A third well would replace spring No. 23. Replacement wells would be completed in the sub-McKay aquifer. Although containing poorer-quality water than the overburden aquifer (chapter II, Hydrology), the sub-McKay aquifer is used for both domestic and livestock water and would provide water of sufficient quantity and quality to support postmining land uses. Should any other springs (Nos. 24 and 26) or wells in the vicinity of Area D undergo significant water losses or degraded quality as a result of mining, Western Energy would be required by law to rectify the situation by, for example, drilling more wells.

Along the southern edge of the mine area, boxcut spoil would be permanently placed over clinker areas. This is not expected to have a significant hydrologic effect because only a small portion of the total clinker deposits in the area would be covered.

Ground Water--Changes After Mining

As mining proceeds up-dip in Area D, spoil from the active cut would be placed in previous cuts, and a spoil aquifer would begin to form, replacing the Rosebud coal aquifer. The spoil aquifer would be recharged by precipitation (onto spoil and adjacent clinker deposits) and by inflow from the adjacent open mine pit areas. Recharge rates would be greater during the active mining operations, when ungraded spoil piles would trap runoff receiving direct recharge from precipitation. Following reclamation, recharge would occur both vertically through the spoil and laterally from the clinker deposits located north of the application area.

Studies conducted at the Rosebud Mine (Stearns et al., 1983, p. 11) indicate that infiltration rates for reclaimed sites are similar to infiltration rates for undisturbed sites. However, Schafer et al. (1979, p. 83) observed that "water is used more rapidly from mine soils than from natural soils." The reason for this could be greater vegetative production on reclaimed sites, increasing evapotranspiration losses. As a result, the potential for deep percolation (recharge) could be slightly diminished within mine areas.

Any water percolating past the root zone, however, would recharge the spoil aquifer. Under existing conditions, the overburden consists of layered sedimentary rock dominated by horizontal flow. Vertically percolating ground water is intercepted by the less permeable strata and follows these strata to emerge at the ground surface as springs and seeps. Little vertical recharge reaches the coal aquifer. As a result of mining, the natural layering of the overburden would be eliminated and the mine pit would be filled with a spoil mix. The replaced overburden (spoil) would have about the same horizontal hydraulic conductivity as the premining strata (Van Voast et al., 1977, p. 38). As a result of the mixing of the overburden strata, however, spoil material would have a greater vertical hydraulic conductivity than the premining strata. Consequently, recharge through the spoil would be potentially greater than recharge through the overburden. This potential for increased recharge may not be fully realized because of the consumption of water within the root zone.

The spoil aquifer would not receive much inflow from adjacent undisturbed aquifers because the ground water system in the mine area is isolated. As such, the spoil aquifer may be expected to form more slowly than spoil aquifers elsewhere near Colstrip.

Flow in the spoil aquifer in Area D would probably follow the geologic dip of the mine pit floor--toward the south--reestablishing the present flow pattern in the Rosebud coal. The spoil aquifer, like the Rosebud aquifer, would discharge in the upper portions of the Cow Creek and Pony Creek drainages.

Changes in ground water quality occur as the ground water passes through mine spoil. The most significant change is an increase in total dissolved solids concentrations. Overburden strata contain soluble salts which are dissolved by the water moving through the mixed overburden spoil. The chemical composition of the water from the spoil can generally be described as a calcium-magnesium-sulfate type water with magnesium usually exceeding calcium

(Western Energy Company, 1983). Total dissolved solids concentrations for spoil waters at the Rosebud Mine range from 1,100 mg/l to 6,700 mg/l, and average about 3,200 mg/l (Western Energy Company, 1983). For comparison, the Rosebud coal averages 1,890 mg/l, and the Rosebud overburden, 1,250 mg/l (Montana Department of State Lands [MDSL] and U.S. Office of Surface Mining [OSM], 1983a, app. B, table 1). Generally, the highest concentrations are found in waters from the oldest mine spoil (Van Voast et al., 1977, p. 29). The initial first flush of mine water through the spoil would probably remove a high percentage of the available salts (Van Voast et al., 1978b, p. 54), allowing water quality to eventually improve over hundreds to thousands of years.

Spoil water concentrations of calcium, magnesium, sodium, bicarbonate, sulfate and chloride would rise in proportions similar to TDS levels (MDSL and OSM, 1983, app. B). The pH of spoil water ranges from about 6.8 to 7.8, slightly lower than overburden water, which ranges from 7.2 to 8.4 (MDSL, 1983, p. KK-10). Iron concentrations in spoil water are also slightly lower, manganese slightly higher, and other trace elements about the same as in overburden water (MDSL and OSM, 1983a, section 2.2.1.3.2).

Boron concentrations of mine spoil are about the same as natural levels found in near-surface ground water and in surface waters around Colstrip. As such, mining has not increased and is not expected to increase boron levels in ground or surface waters (MDSL, 1983, p. III-8).

Spoil water can generally be used for watering horses and cattle, although a period of adjustment may be necessary. Horses can safely drink water containing TDS levels up to 6,400 mg/l and cattle between 7,000 (dairy) and 10,000 (beef) mg/l TDS levels (McKee and Wolf, 1961, p. 183). Livestock using water with such high concentrations may have to drink more often and may suffer diarrhea for a few days until adjusted. Spoil water is generally unfit for poultry, swine, sprinkler irrigation, or domestic use.

With the formation of the spoil aquifer, spoil water would again discharge within hundreds of years to the headwaters of Cow Creek and Pony Creek. The potential exists for a few new springs and seeps to develop in topographic lows at the edges of the reclaimed area. Discharge water quality would be similar to spoil water. The degree of similarity depends upon amount of dilution by unaffected ground water. In the Cow Creek drainage, spoil water from Area D would have a cumulative effect with water discharging from Area E and from old unreclaimed Northern Pacific spoil. This cumulative impact was previously analyzed by MDSL and OSM (1983a) and is reexamined later in this section.

Spoil water would also discharge to the Pony Creek drainage, where the water is likely to reestablish a zone of saturated alluvium on Pony Creek downstream of the coal outcrop. Because spoil water would be of poorer quality than the existing alluvial source water, TDS concentrations in the alluvial water and in the downstream pond would increase. The increase, however, would not be enough to adversely affect livestock or wildlife.

With the formation of the spoil aquifer, downward movement of spoil water would introduce some poor quality spoil water into the McKay aquifer. The potential for degradation of water quality in the McKay aquifer is limited by

the low hydraulic gradients involved and by the normally low vertical hydraulic conductivities of the interburden. In limited areas, the interburden is composed mainly of sandstone, which would allow slightly greater water flow from the spoil to the McKay coal seam. Overall, the amount of downward flow would be small and would be diluted by the existing flow in the McKay coal aquifer. The water quality of McKay springs discharging in the upper Cow Creek watershed probably would not be significantly affected.

Surface Water--Changes During Mining

Mining in the Area D application area and life-of-mine expansion would affect ephemeral tributary drainages of Spring Creek, Pony Creek, Cow Creek, and East Fork Armells Creek. During mining, increased runoff and sediment would be expected from disturbed, unvegetated areas. Runoff would flow into the mine pit or sediment ponds and traps designed for total containment of runoff from the 10-year, 24-hour storm event. Much of the intercepted water would be permanently lost from surface flow: Some would seep into the ground, some evaporate, and some would become water for dust control.

Any water discharged from sediment ponds would be released between 4 and 15 days after a runoff event and at a time of low- or no-flow conditions in area streams. The overall impact of sediment ponds would be both to delay and to diminish runoff to ephemeral channels downstream of the mine area (table III-1). During most years, it is unlikely that any surface flows would leave the mine area boundaries.

TABLE III-1

Calculated Maximum Impacts of Area D Mining on Average Annual Flow for Spring, Pony, Cow, and East Fork Armells Creeks

		Application Area		Application and Life-of-Mine Area	
Stream	Existing Avg. Annual Yield (acre-ft.)[1]	Max. Reduction in Yield (acre-ft.)	Percent Decrease	Max. Reduction in Yield (acre-ft.)	Percent Decrease
East Fork Armells Creek	1,181	36	1.9	36	1.9
Spring Creek	452	16	3.6	20	4.3
Pony Creek	282	25	8.7	38	14.0
Cow Creek	597	33	5.6	42	7.1

Source: P. Norbeck, Hydrological Engineer, Western Energy Company, pers. comm., August 30, 1984.

[1]Annual yield calculated at confluence with Rosebud Creek for Spring, Pony, and Cow Creeks and at USGS station downstream of Colstrip for East Fork Armells Creek.

The quality of surface waters in the drainages downstream of Area D are not expected to change significantly after mining. Runoff exceeding the 10-year, 24-hour event would not be contained by sediment ponds. Instead, it would enter receiving streams at a time of naturally high sediment concentrations, when the contribution of sediment from the mine area would be insignificant.

Discharge of mine pit water would occur only infrequently, and the impacts to the surface water quality of area streams would be minor. The quality of pit water would vary, depending on the mixture of surface and ground water sources. Pit water would be pumped to sediment ponds and released according to discharge permit requirements.

Surface Water--Changes After Mining

Sediment ponds would probably remain for a minimum of 10 years after mining. The ponds would continue to delay and diminish downstream surface water flows until the ponds are removed. By law, sediment ponds cannot be removed until reclamation has been determined by DSL to be successful.

Following removal of sediment ponds, surface water runoff from the mine area would approximate premining conditions with only minor changes in the amount and timing of discharge. In general, the postmining topography would be gentler than premining conditions and would contain some differences in drainage areas, hillslopes, and channel configurations. The gentler topography would slightly reduce slope runoff and would reduce snow accumulation in drainage channels, thus decreasing snowmelt runoff.

Some minor adjustments to stream channels may occur after sediment pond removal (MDSL, 1983, p. III-11). Sediment which was stored along ephemeral channels upstream of the ponds would be subject to renewed erosion. After the ponds are removed, the sediment would move downstream in large pulses during storm events. Adverse water quality effects would probably be minor, because channel changes would be localized and high sediment concentrations would be diluted downstream.

Mining and reclamation would alter vegetative conditions, and this would change the near-surface hydrologic system. However, the changes in the system would be minor. The reclaimed grassland in Area D, as elsewhere at the Rosebud Mine, would probably have more vegetative cover than native rangeland. Although the increased cover might be expected to slightly reduce surface runoff, studies at the Rosebud Mine (Stearns et al., 1983) concluded that infiltration rates on undisturbed and reclaimed areas were not significantly different.

Removal of 800 acres of ponderosa pine would temporarily alter the pattern and amount of snow accumulation, and would increase the volume and change the timing of snowmelt runoff. Studies in Arizona and New Mexico (Hibbert, 1981, p. 225) indicate that annual water yield in snowmelt areas can be increased by as much as 3 inches by clearing mature, well stocked ponderosa pine forests. The effect would not be as great in Area D, but an overall increase in runoff would be expected.

Because the mine area includes such a small percentage of the Spring, Pony and Cow Creek drainage basins, increased runoff would be undetectable except very near the mine. As normal grazing practices are resumed and the ponderosa pine forests become reestablished, runoff rates would tend toward premining conditions.

In the area where old Northern Pacific spoil would be regraded and revegetated, postmining runoff would increase. Runoff from this area is currently trapped in depressions in the unreclaimed spoil topography. These areas, which Western Energy would not be required to retopsoil, may also have less vegetation cover than other reclaimed areas, resulting in slightly higher runoff and sediment yields than other reclaimed areas.

Postmining ground water discharges are not anticipated to significantly affect the quality and quantity of stream flows in the areas next to Area D. Nearby streams flow only after heavy rainfall and snowmelt, although alluvial aquifers discharge minor amounts to surface flows in the lower portions of the drainages. Spoil aquifers would contribute low quality spoil water, primarily to alluvium in Cow Creek. (The effect of this discharge to alluvial ground water systems is assessed under Cumulative Hydrologic Impacts.) Any impacts to surface water quality in Cow Creek would probably be undetectable.

Overall, the postmining alluvial bottoms near the mine would probably be drier than the premining conditions due to loss of overburden springs and seeps, and decreased snow accumulation.

Cumulative Hydrologic Impacts

Ground water discharge in the upper Cow Creek watershed would be the only way that mining in Area D would contribute to cumulative hydrologic impacts at the Rosebud Mine. All other ground water effects in Area D would be isolated from the rest of the mine, and surface water effects to East Fork Armells Creek would be negligible. For a detailed discussion of cumulative impacts of all mining, municipal, and industrial activities for the Colstrip area, refer to the Final Rosebud Mine Comprehensive Study (MDSL and OSM, 1983a).

During mining in Area D, discharge to alluvium in the upper end of Cow Creek could be reduced by 5 to 13 gpm by mining in the application area, and 1 to 2 gpm more by mining in the life-of-mine expansion (MDSL on-file report, Calculations of Salt Loading to Cow Creek). After mining ends, ground water discharge from Area D would still be less than today, owing primarily to reduced recharge in the area of the Northern Pacific spoil.

Average predicted spoil water quality in Area D would be about 3,200 mg/l TDS (P. Norbeck, pers. comm., August 30, 1984), which is within the range (2,000 to 4,000 mg/l TDS) predicted for most of the spoil in the Rosebud Mine area (MDSL and OSM, 1983a, p. 3-50). Discharge of spoil waters from Area D would increase TDS levels in Cow Creek alluvial water. Overall, total dissolved solids concentrations in Cow Creek alluvium at a point three miles downstream of the Area D boundary would increase by an estimated 1 to 2 percent as a result of mining in the application area and by 2 to 3 percent from mining all of Area D. These increases are similar to those anticipated from

Area E mining and would result in a combined increase in TDS levels in Cow Creek alluvial ground water of up to 5 percent (MDSL and OSM, 1983a, p. 3-50).

Cumulative impacts of industrial pond seepage on ground water quality and flow in Cow Creek alluvium could exceed anticipated mining impacts, but would take longer to reach Cow Creek. Both mining and industrial pond impacts to Cow Creek alluvium would last for thousands of years. For a more complete discussion of combined industrial and mining impacts, refer to the Comprehensive Rosebud Mine Study (MDSL and OSM, 1983a).

Significant impacts to alluvial ground water in Spring and Pony Creeks are not anticipated from mining in Area D or other areas. The total effect of all mining activities on Rosebud Creek, including the effects of the Big Sky Mine, would be less than a one percent increase in TDS levels (MDSL and OSM, 1983a, p. 351).

Due to limited pre- and postmining contributions of ground water from Area D to East Fork Armells Creek alluvium, mining impacts would not be significant. For a discussion of cumulative impacts to East Fork Armells Creek by municipal, industrial, and mining development in the Colstrip area, refer to the Comprehensive Rosebud Mine Study (MDSL and OSM, 1983a).

Mitigating Measures

Selective placement of saline overburden would reduce TDS level increases in postmining spoil water. Selective placement techniques using draglines have been successfully demonstrated in Area B, where they increased direct operating costs by about 12 percent (Dollhoph et al., 1981, p. 79). The degree to which selective placement of saline material on a mine-wide scale would reduce TDS concentrations in spoil water has not been determined. Predictions of postmining water quality with and without selective placement techniques would be difficult and speculative.

Disposal of initial boxcut spoil somewhere other than in clinker areas would prevent reductions in recharge for these areas. However, recharge and ground water occurrence for clinker in Area D is not well understood and thus the importance of this mitigating measure cannot be quantified.

A six-percent decrease in ground water discharge to spring No. 24 has been projected as a result of mining in the application area (Western Energy Company, 1984a, p. 42a). Mining in the life-of-mine expansion would further decrease spring flow. Spring No. 24 provides water to a stock pond located downstream of the spring. Given the uncertainty of projecting impacts to springs, the effect of mining could be significantly greater, although mining would probably not completely dry up the spring. Flows to the stock pond could be periodically monitored to quantify changes. If flow decreases significantly during mining, a sub-McKay well could be provided as an alternate source of stock water.

To reduce inflow of spoil water from the old Northern Pacific spoil into the boxcut, a buffer of undisturbed coal and overburden could be maintained between the boxcut and the old unreclaimed spoil. This would reduce the

necessity of having to pump large quantities of poor quality spoil water into the runoff and sediment control system where it would probably have to be released to area streams.

SOILS

Summary of Impacts: Some impacts to the soil resource would occur during soil salvage, storage, and replacement. These include reduction of soil porosity, alteration of soil structure, and dilution of organic matter levels in the near-surface horizon. Microbial activity would be reduced, at least temporarily, in the reconstructed mine soil. Increased rates of soil loss by wind and water erosion can be expected prior to the reestablishment of vegetation. Overall, impacts to soils would not be significant.

Soil Salvage and Redistribution

Western Energy Company proposes to salvage and redistribute enough soil to cover the Area D disturbance area to a depth of approximately 2 feet. The soils would be salvaged and replaced in two lifts, segregating the top 6 to 8 inches from the subsurface layers. Considering the fair to good quality of the soils and overburden in Area D, this depth would be adequate to achieve revegetation success. Of the total 3,465 acres disturbed, 440 acres (369 acres of spoil and 71 acres of soil storage areas) would not be topsoiled. Since strippable soil material is not present in the spoil areas, Western Energy is not responsible for soil replacement in these areas prior to revegetation. Although considered "disturbed," the soil storage areas serve only as temporary storage areas for topsoil and, consequently, topsoil needs to be neither stripped nor replaced.

Western Energy has recommended stripping depths which in some instances are too deep and in others too shallow. The proposed stripping depths for the Busby, Spang, and Reidel soils are too deep. These soils have intermittent layers of sandy material, increasing the hazard of both water and especially wind erosion in the reconstructed mine soil. The stripping depths proposed for the Kirby and Birney soils are also too deep. These soils have large amounts of rock fragments in their subsurface layers, usually exceeding 35 percent below 6 inches. In one map unit, the depth to unsuitably high amounts of rock fragments in the Birney soil is 12 inches. The stripping depth for the Delpoint soil is shallower than the thickness of suitable material. Delpoint has soft bedrock between 20 and 40 inches, with an average depth of 30 inches.

As shown in table III-2, Western Energy proposes to salvage and replace approximately 4,302 acre-feet of soil material in the application area and 5,768 acre-feet from the application area and life-of-mine expansion combined. These proposed volumes are very close to the potential soil volumes. The potential volumes, based on stripping some soils to a depth different from what the company proposes, are 4,282 acre-feet for the application area and 6,076 acre-feet for all of Area D.

TABLE III-2

Soils in the Proposed Disturbance Area of Area D

Mapping Unit Name[1,6]	Recommended Soil Salvage Depths[2] (feet)		Estimated Soil Salvage Volumes[2] (acre-feet)								Primary Limiting Factor
			Application Area				Application and Life-of-Mine Area				
	Proposed[3]	Potential[4]	Acres	Acres	Proposed[3]	Potential[4]	Acres	Acres	Proposed[3,5]	Potential[4]	
Busby Fine Sandy Loam	2.0	1.0	422.0	422.0	844.0	422.0	500.7	500.7	1,001.4	1,001.4	Excess sand
Kremlin Loam	6.0	6.0	22.0	22.0	132.0	132.0	23.3	23.3	139.8	139.8	None
Cooers Loam	5.5	5.5	9.5	9.5	52.3	52.3	28.5	28.5	156.8	156.8	None
Spang Sandy Loam	2.0	1.0	25.0	25.0	50.0	25.0	27.0	27.0	54.0	54.0	Excess sand
Yamac Loam	5.0	5.0	343.0	343.0	1,715.0	1,715.0	409.6	409.6	2,048.0	2,048.0	Excess salts
Delpoint Loam	2.0	2.5	194.0	194.0	388.0	485.0	297.5	297.5	595.0	595.0	Bedrock
Birney-Cooers-Kirby Complex	1.5		37.5		56.3		90.3		135.5		
Birney part		1.0		15.0		15.0		36.1		36.1	Rock fragments
Cooers part		5.5		7.5		41.3		18.1		99.3	None
Kirby part		0.5		7.5		3.8		18.1		9.0	Rock fragments
Inclusions		1.5		7.5		11.3		18.1		27.1	—
Birney-Kirby Channery Loams	0.5		40.0		18.6		139.0		64.6		
Birney part		0.5		18.0		9.0		62.6		31.3	Rock fragments
Kirby part		0.5		12.0		6.0		41.7		20.9	Rock fragments
Inclusions		0.5		10.0		3.6		34.8		12.5	—
Birney-Kirby-Cabbart Complex	0.5		30.5		14.2		34.6		16.1		
Birney part		0.5		12.2		6.1		13.8		6.9	Rock fragments
Kirby part		0.5		6.1		3.1		6.9		3.5	Rock fragments
Cabbart part		0.5		6.1		3.1		6.9		3.5	Bedrock
Inclusions		0.5		6.1		2.9		6.9		3.3	—
Busby-Yetell-Rock outcrop Complex	1.0		12.0		10.2		12.0		10.2		
Busby part		1.0		4.8		4.8		4.8		4.8	Excess sand
Yetull part		1.0		4.8		4.8		4.8		4.8	Excess sand
Rock outcrop part		0.0		1.8		0.0		1.8		0.0	—
Inclusions		1.0		0.6		0.6		0.6		0.6	—
Busby-Reidel Complex	1.5		183.5		256.0		406.1		566.5		
Busby part		1.0		110.1		110.1		243.7		243.7	Excess sand
Reidel part		1.0		45.9		45.9		101.6		101.6	Excess sand
Rock outcrop part		0.0		12.8		0.0		28.3		0.0	—
Inclusions		1.0		14.7		14.7		32.5		32.5	—
Cabbart-Delpoint Loams	1.0		59.0		55.6		160.6		151.2		
Cabbart part		1.0		29.5		29.5		80.3		80.3	Bedrock
Delpoint part		2.5		14.8		37.0		40.3		100.7	Bedrock
Inclusions		0.5		14.7		5.7		40.0		15.6	—

Cabbart-Yawdim-Rock outcrop Complex	0.5		206.0		77.3		224.3		84.1		
Cabbart part		1.0		61.8		61.8		67.3		67.3	Bedrock
Yawdim part		0.5		61.8		30.9		67.3		33.6	Excess clay
Rock outcrop part		0.0		51.5		0.0		56.1		0.0	—
Inclusions		0.5		30.9		15.5		33.6		16.8	—
Delpoint-Cabbart Loams, steep	1.5		310.0		465.0		374.8		562.2		
Delpoint part		2.5		170.5		426.3		206.1		515.4	Bedrock
Cabbart part		1.0		77.5		77.5		93.7		93.7	Bedrock
Inclusions		1.5		62.0		93.0		75.0		112.4	—
Delpoint-Cabbart Loams, very steep	0.5		228.0		102.6		228.0		102.6		
Delpoint part		2.0		91.2		182.4		91.2		182.4	Bedrock
Cabbart part		1.0		68.4		68.4		68.4		68.4	Bedrock
Rock outcrop part		0.0		22.8		0.0		22.8		0.0	—
Inclusions		1.5		45.6		68.4		45.6		68.4	—
Rentsac-Delpoint Complex	1.5		23.5		35.3		30.5		45.8		
Rentsac part		1.5		14.1		21.2		18.3		27.5	Bedrock
Delpoint part		2.0		7.0		14.0		9.1		18.2	Bedrock
Inclusions		1.5		2.4		3.6		3.1		4.7	—
Spang-Birney Complex	1.0		29.0		29.0		33.9		33.9		
Spang part		1.0		11.6		11.6		13.6		13.6	Excess and
Birney part		1.0		10.1		10.1		11.8		11.8	Rock fragments
Inclusions		1.0		7.3		7.3		8.5		8.5	—
Kirby-Cabbart-Rock outcrop Complex	0.5		0.5		0.2		0.7		0.3		
Kirby part		0.5		0.2		0.1		0.3		0.1	Rock fragments
Cabbart part		0.5		0.1		0.1		0.1		0.1	Bedrock
Rock outcrop part		0.0		0.1		0.0		0.1		0.0	—
Inclusions		0.5		0.1		0.0		0.1		0.1	—
Mine spoil & ponds	0.0	0.0	369.0	369.0	0.0	0.0	372.6	372.6	0.0	0.0	—
Soils Storage Areas	0.0	0.0	71.0	71.0	0.0	0.0	71.0	71.0	0.0	0.0	
TOTALS			2,615.0	2,615.0	4,301.6	4,281.8	3,465.0	3,465.0	5,768.0	6,076.0	

[1] Although separated during the soil survey due to slope differences, mapping units containing the same soil series were combined in this table for purposes of clarity. This does not affect proposed or potential soil salvage depths or volumes.

[2] Actual salvage depths and volumes would be determined in the field during Western Energy's proposed presalvage sampling program. The figures listed in the columns include both topsoil and subsoil combined, although the soil would actually be salvaged in two lifts.

[3] Proposed by the Western Energy Company, 1984a, vol. 1, p. 106.

[4] Potential based on review of all available soil data for each soil series. (See discussion under Soil Quality.)

[5] Volume for some map units varies from Area D permit application due to failure of Western Energy to consistently adjust for rock outcrop.

[6] Inclusions include rock outcrop without strippable soil.

Soil Quality

The overall quality of the redistributed soils would be somewhat lower than that of undisturbed soils. Soil salvage and redistribution would cause some reduction of soil organic matter and microbial activity, disruption of pore continuity, and alteration of soil structure. These unavoidable soil impacts would be significantly reduced by the company's plan to haul 90 percent of the soil material directly (without storage) to regraded reclamation areas when weather and field conditions permit. Mixing, which would occur during soil salvage and redistribution, would dilute the carbonate levels found in some soils.

The unavoidable impacts are expected to be only temporary. In time and with proper land use management, the soil would be able to sustain productive, natural vegetation that, for all practical purposes, would be indistinguishable from the vegetation on native, undisturbed soils.

As in some of the other Rosebud Mine areas, Western Energy would implement both a presalvage and postreplacement sampling program for soils. Prior to stripping, those areas suspected of containing unsuitable soils (having high clay or salinity levels) would be sampled approximately every 400 feet. Sampling would reach 6 inches deeper than the proposed salvage depth. Each sample would be divided into 6-inch increments for analysis. If analysis indicates excess salts or unfavorable textures, stakes would be placed to direct the scraper operator to avoid the problem layers. This practice would maximize soil salvage volumes while minimizing salvage of unfavorable material.

After soil replacement and prior to reseeding, the reconstructed mine soil would be sampled to assure that adequate amounts of plant nutrients are present. Sampling would be at the intensity of one site per ten acres. Analytical criteria and methodology would follow Montana Department of State Lands (MDSL) guidelines.

Sandy-textured soils comprise approximately 15 percent of the total potential volume of the application area and 14 percent of the application area and the life-of-mine expansion combined (table III-2). Western Energy would separate these from other soils and respread them only on slopes of less than 10 percent and on areas away from drainageways. Such handling would reduce soil loss from water erosion.

Western Energy proposes to develop a plan for reestablishment of plant rooting zones which are compatible with the intended postmining plant communities. This plan, submitted to the Department of State Lands, would take into account plant rooting depths, topsoil thickness, topsoil texture, and spoil composition and condition.

Mitigating Measures

Reducing the salvage depths for the Busby, Spang, and Reidel soils would decrease the total volume of these soils used in soil replacement. Consequently, the potential for wind and water erosion in the reconstructed mine soil would be reduced. Available water capacity in the mine soil would be higher. Increasing the salvage depths for the Delpoint soil would increase the total volume of soil available for salvage and replacement.

VEGETATION

Summary of Impacts: During reclamation, Western Energy would replace the major premining vegetation types. The only exception would be the 120 acres of cropland, which would be converted to rangeland. Conversion of cropland and other areas (e.g., mine spoil, disturbed grassland, ponds, and ranchyard) to rangeland would increase grazing capacity.

Mining and reclamation would decrease species diversity and create a less complex mosaic of vegetation for several decades after mining. Ponderosa pine (Pinus ponderosa) stands with diverse canopy and tree size characteristics would also be lost for several decades, or longer. If reestablishment of ponderosa pine is unsuccessful, the loss would be significant, since 49 percent of the ponderosa pine vegetation type of the Rosebud Mine occurs on the Area D application area and life-of-mine expansion. Otherwise, impacts would not be significant.

Revegetation of mined land would be initiated by hauling topsoil salvaged during mining directly to reclamation areas (direct-hauling). Approximately 90 percent or more of the topsoil removed would be direct-hauled. Plant seeds, tubers, and roots would thus remain viable within the soil. Natural regrowth of many species would be expected as a result, even without further revegetation efforts.

Topsoil that would not be direct-hauled (approximately 10 percent) would be stockpiled for 20 or more years. Stockpiling would destroy most viable seeds, roots, and tubers, as well as organic matter and soil microbes that help establish many native plants. Revegetation of stockpiled topsoil after redistribution would be slower than revegetation of direct-hauled topsoil. Topsoil, stockpiled for 3 or more years, loses beneficial soil fungi necessary for optimum growth of many plants (Rives et al., 1980). These fungi, through complex biological interactions with plant roots, promote absorption of moisture and nutrients and increase survival of plants under conditions of moisture stress and competition with invader species. Natural colonization of beneficial soil fungi would occur in stockpiled soil after an unknown time period. Because, however, the portion of Area D to be reclaimed with stockpiled topsoil is a narrow strip adjacent to undisturbed native range, natural colonization probably would be relatively rapid.

On slopes of 10:1 (10 percent) or greater, native grass or wheat straw mulch would be applied at 1,500 to 3,000 pounds per acre and anchored to the soil. Mulching as proposed would reduce erosion and increase soil moisture. Native grass mulch also would be a seed source for native species for which seed may not be available commercially.

Reclamation would result in a simplified mosaic of vegetation types and reduced species diversity for several decades. This would in part stem from

unavoidable soil impacts and in part from gentler postmining topography. Mixing of soils, destruction of soil profiles, and destruction of microhabitats would reduce site variability, which currently contributes to the area's plant diversity. The gentler postmining topography would create a drier growing environment by eliminating steep drainages, which collect snow, are protected from the wind and sun, have reduced evapotranspiration rates, and thus provide more moisture to plants.

An additional source of moisture that would be lost would be the coal seams or other water-conducting strata that intercept drainages and release water to the surface. The horizontal water movement through the coal and rock strata would be reduced during mining. As a result, the size of the small plant community at spring No. 24 in the upper Pony Creek drainage that depends on high water levels would be reduced.

Existing plant communities covering 2,615 acres would be destroyed by mining and related activities over an 18-year period in the application area. The life-of-mine expansion would extend the mining activities to 23 years and result in the destruction of 850 more acres. The only community permanently lost would be the cropland, since it would not be replaced during reclamation. Other communities would be replaced in about the same acreages that existed before mining (table III-3).

TABLE III-3

Acreage of Premining and Postmining Plant Communities

Plant Community	Premining Acreage	Postmining Acreage		
		Application Area	Life-of-Mine Area	Total
Grassland	1,311	1,492	389	1,881
Big sagebrush-grassland	12	17	0	17
Silver sagebrush-grassland	134	118	35	153
Skunkbush sumac-grassland	310	135	153	288
Rubber rabbitbrush	6	0	0	0
Ponderosa pine-grassland	1,123	847	273	1,120
Agricultural	127	0	0	0
Disturbed grassland	63	0	0	0
Ungraded mine spoil	169	0	0	0
Regraded mine spoil	185	0	0	0
Sandstone outcrops	3	3	0	3
Ponds	18	3	0	3
Ranchyard	4	0	0	0
Total	3,465	2,615	850	3,465

Sources: Western Energy Company, 1984a.
Chuck Rose, Western Energy Company, pers. comm., May 17, 1984.
Note: See chapter II, Vegetation, for detailed breakdown of premining acreages.

Grazing

Based on studies by Schafer (1984), it appears that reclamation on Rosebud Mine's Area A has increased grazing capacity. Deeper soils and gentler slopes account for the improvement of potential forage production over premining conditions. It is expected that future reclamation of Area D would similarly increase grazing capacity within 3 to 5 years of initial seeding.

The conversion of cropland, ungraded spoil, some existing plant communities, ranch facilities, and ponds to grasslands would result in a 570-acre increase of rangeland (table III-3). This would further increase Area D's grazing capacity. (See Land Use.)

Grasslands

Grass species would tend to predominate throughout Area D because they are adapted to dry sites. The drier soil environment created by the gentler postmining topography would create harsher conditions for reestablishing conifers and some deciduous trees and shrubs.

The establishment of some species such as warm-season grasses and forbs after mining has proven to be difficult. Thus, Western Energy has devised reclamation plans to favor warm-season grass production and overall species diversity. The company would use deferred-rotation grazing to reduce the dominance of aggressive cool-season grasses. Two-phase planting also would promote a diverse vegetative cover. The first-phase seeding mixture would contain forbs, shrubs, and warm-season grasses that are difficult to establish due to slow rates of initial growth or competition with more vigorous cool-season species. The second-phase seeding mixture would contain cool-season species which would be interseeded one to three growing seasons after the first-phase seeding.

Shrubs

Establishment of dominant shrubs in Area D, silver sagebrush (*Artemisia cana*) and skunkbush sumac (*Rhus trilobata*), would be initiated by both seeding and planting seedlings. Seedlings would be planted at a density of 50 to 100 per acre. Seed would be applied at a rate of 1 pound per acre for silver sagebrush and 2 pounds per acre for skunkbush sumac. Plantings would be supplemented with tree spade transplants. Although the initial planting density for silver sagebrush and skunkbush sumac seedlings would be considerably less than the desired density, seed production by the planted seedlings would likely increase shrub densities to premining levels within one to two decades. Both silver sagebrush and skunkbush sumac would also grow from root sprouts.

Although Western Energy has no specific plans to reclaim the deciduous shrub vegetation type, this type might become reestablished on moist sites by seed dispersed from scattered shrubs that would be planted by Western Energy after mining. In addition, natural seed dispersal from offsite stands of this

type might increase the density of shrubs on small areas of mined land with suitable topographic and moisture conditions. In the absence of specific reclamation measures to provide suitable site conditions for growth of this type, several decades or longer probably would be required for reestablishment.

Conifers

Proposed reclamation would replace almost all of the acreage of the ponderosa pine-grassland vegetation type destroyed by mining (table III-3). Although successful reclamation of this type would be expected, numerous environmental, climatic, and management factors could hinder reestablishment of ponderosa pine (Pinus ponderosa). To date, no stands of reproducing, mature ponderosa pine approaching premining densities have been established and maintained on mined lands in eastern Montana.

Western Energy has committed to planting 100 ponderosa pine seedlings per acre, scattered non-uniformly over the conifer replanting area. If only 25 percent success is achieved, the premining tree density of 24 trees per acre would be reestablished, at least in the short term.

Research has identified limitations for reclamation of ponderosa pine on mined lands and has provided information which should allow for improved reforestation success of this species on Area D (Stark, no date, 1982, 1983; Blake, 1983; Running et al., 1983; Amendola et al., 1984). Western Energy could improve reclamation success of ponderosa pine by planting seedlings in special plastic tubes to prevent rodent damage; applying herbicides to reduce plant competition; planting on north slopes to reduce water stress; excluding cattle from planting sites; planting on deep, well-drained sandy loams; introducing nonporous, dark-colored rocks into the rooting zone and soil surface; and applying water, fertilizer, and compost in a judicious manner.

The growth rate of trees on reclaimed sites is not known. It is probable, however, that it would take 50 or more years for reestablishment of the pine stands similar to those now growing in the area. Recent data from Colstrip show that approximately 50 years are required for pines to reach 30 feet in height and approximately 80 years to reach 45 feet or more (ECON, 1981). Growth rates of pine on reclaimed sites probably would not exceed rates for trees on undisturbed sites.

The stand characteristics and visual aspect of the reclaimed type would differ from the natural type. Stands of trees on reclamation areas would probably be uniform in age and size, whereas existing stands are diverse in age, size, and canopy characteristics.

Along with ponderosa pine, Rocky Mountain juniper (Juniperus scopulorum) may be difficult to reestablish. To date, juniper reestablishment has been erratic and little appears to be known concerning what conditions are essential to successful reclamation (Coenenberg, pers. comm., August 21, 1984). Although Western Energy plans to plant 6 to 10 juniper seedlings per acre on Area D, this species could be eliminated until it is reestablished by offsite plants. Western Energy's research on juniper reclamation may improve revegetation success in the future.

Cumulative Impacts

The contribution of the Area D application area and life-of-mine expansion to the cumulative impacts of the Rosebud Mine are proportional to the acreages of the plant communities that would be disturbed in Area D (table III-4). The most significant contribution that Area D would make to the cumulative impacts of the entire mine relates to the ponderosa pine-grassland vegetation type. The application area covers 36 and the life-of-mine expansion 13 percent of the total acreage of this vegetation type that would be disturbed by the Rosebud Mine. Because of uncertainties of long-term reestablishment and changes in stand characteristics of ponderosa pine, the Area D contribution (approximately 49 percent of the total) to cumulative impacts could be significant.

The loss of cropland as a result of mining Area D, as compared to the loss as a result of the entire Rosebud Mine, would be small (table III-4). The application area and life-of-mine expansion together compose approximately 7 percent of the cropland that would be lost to production as a result of mining the entire Rosebud Mine.

TABLE III-4

Percentage of Rosebud Mine Plant Communities in Area D

Plant Community	Total Rosebud Mine Acreage	Percentage in Application Area	Percentage in Life-of-Mine Area	Percentage in Areas A,B,C,&E
Grassland	6,548	16	4	80
Shrub-Grassland	5,362	5	4	91
Conifer-Grassland	2,329	36	13	51
Cropland	1,677	7	0	93
Disturbed Grassland	609	2	9	89
Spoil	1,155	30	0	70
Other	922	3	0	97

Sources: Western Energy Company, 1984a.
Montana Department of State Lands and U.S. Office of Surface Mining, 1983a.

Note: For example, 16 percent of the total grassland plant community in the Rosebud Mine occurs in the application area; 4 percent occurs in the life-of-mine expansion. The remaining 80 percent of the grassland occurs in the other mining units.

Mitigating Measures

Although pines would probably become established, the trees would be of similar age and size. Therefore, Western Energy could plant more pines every five to ten years after the initiation of reclamation to restore stands of uneven age and size, thereby approximating premining conditions.

Because grazing is proposed as a management tool, livestock could damage saplings and young trees. Western Energy could fence clumps of trees or individual trees to assure protection from livestock.

Other measures that may reduce losses of young seedlings have been presented in the Rosebud Mine's Comprehensive Study (Montana Department of State Lands and U.S. Office of Surface Mining, 1983a). Still more techniques should be devised to reduce predation by rodents and other wildlife. Western Energy should continue research on preventing or reducing predation on pines.

Specific reclamation measures could be devised to reestablish the upland deciduous shrub type:

(1) Planting on north slopes to take advantage of increased soil moisture.
(2) Construction of concave drainages to promote snow accumulation and collection of runoff.
(3) Placement of suitable soils to promote moisture infiltration and storage and to reduce erosion.
(4) Restriction of grazing to prevent destruction of shrubs.

WILDLIFE

Summary of Impacts: Major direct impacts to most wildlife would be temporary and limited to the area of disturbance. Wildlife species dependent upon ponderosa pine, shrub, and grassland habitats would lose nests, forage, and shelter until these habitats could be reestablished. Also lost until successful reclamation would be habitat for pronghorn, predators, turkeys, songbirds, raptors, and sharptail grouse.

Habitat Loss

The major direct impact to wildlife within Area D would be destruction of habitat. In the Area D application area, 2,615 acres would be disturbed. Of this acreage, 1,025 acres are grassland, 830 conifer-shrubland, 350 spoil, 255 shrub-grassland, 120 cropland, and 35 other. In the Area D life-of-mine expansion, 850 acres would be disturbed. Of this acreage, 293 acres are conifer-shrubland, 286 grassland, 207 shrub-grassland, and 64 other. Other habitat features lost during mining include 18 acres of pond and 3 acres of rock outcrops. The 3,465 acres which would be disturbed on Area D represent approximately 19 percent of the total area proposed for eventual disturbance on the Rosebud Mine.

Reclamation for Wildlife

Strip mining in Area D would remove vegetation gradually, as mining progresses. Only those areas to be mined immediately would be stripped of vegetation

and soil. Reclamation of mined areas would begin within a few years of vegetation and soil stripping. Direct back-haul of topsoil (see Soils) would speed the revegetation process and reduce the effect of habitat destruction.

On the application area and life-of-mine expansion, reclamation would create an additional 570 acres of grassland. Agricultural land, disturbed grassland, and mine spoil would be converted to grassland. Shrub-grassland and conifer-grassland habitats would be reclaimed to their approximate premining acreage. The 3 premining acres of rock outcrops would be replaced by piles of boulders. Three of the 18 premining acres of ponds would be replaced temporarily as sediment ponds.

Big Game

Mule Deer

Mining would remove habitat now used by mule deer for forage, travel, and escape. Deer depending on all or any portion of the area to be disturbed would be forced from the area. This displacement could be a negative impact because adjacent unmined mule deer habitat may be near carrying capacity. Competition for forage could result.

Reclamation of grassland and shrub-grassland habitat would probably result in forage production higher than before mining. (See Vegetation.) Two-phase seeding (planting shrubs and forbs prior to grass) would increase the chances for survival of the nongrass species that are heavily used by mule deer. Plant diversity in reclaimed areas is expected to be lower than premining levels for many years, but would increase with time as sites are naturally seeded. Grassland and shrub-grassland reclamation may ultimately provide better forage and cover for mule deer, but until the plant community matures and becomes diverse, mule deer use of Area D would probably be lower.

Efforts to establish conifer-grassland habitat would be difficult, and, if successful, would take up to 50 years to produce mature trees. (See Vegetation.) Thermal, travel, and escape cover provided by conifer-grassland habitat is important to deer that forage in shrub-grassland habitat. If conifer-grassland habitat is not reestablished successfully, mule deer may not use shrub-grassland habitat as extensively. In this case, mule deer use of Area D would be lower than before mining.

Human disturbance of mule deer on reclaimed land would be minimal. As long as Western Energy controls the surface, the prohibition of firearms and hunting may create a refuge that attracts deer during hunting season.

Pronghorn

Mining would remove habitat now used by pronghorn on Area D. Pronghorn using this habitat would be displaced to undisturbed areas, and may compete with pronghorn outside Area D.

Reclaimed grassland and shrub-grassland habitat on Area D would cover 570 more acres than before mining. Successful shrub and forb reestablishment with the two-phase seeding technique and shrub-tubeling planting technique proposed by Western Energy (see Vegetation), would eventually provide more and better pronghorn habitat than before mining. Until these habitats are reestablished, pronghorn would use Area D less than before mining.

Other Mammals

Predators

Mining would remove habitat used by both predators and their prey (primarily smaller mammals and birds). Since the predators use a variety of habitats and only lightly populate areas surrounding Area D, displacement of those animals using Area D would probably not affect predator populations.

Reclaimed shrub-grassland and grassland habitats would potentially support greater numbers of small mammals and rodents. Densities of deer mice as high as ten times greater than in natural communities have been recorded on reclaimed lands (Pitcher, 1977). Predators would possibly find more prey on reclaimed land and respond by using these areas more than before mining.

Medium and Small Mammals

Mining would remove habitat now used by medium and small mammals. Many small mammals would probably be killed during mining.

Successful reclamation of habitats used by medium and small mammals may lead to increased densities of these animals. Reclamation would probably reduce small mammal diversity in favor of higher deer mouse populations. Western Energy would place rock piles in reclaimed areas to create microhabitats suitable to small mammals, reptiles, and birds. Woody shrubs such as skunkbush sumac and rose would be planted next to the rockpiles.

Upland Game Birds

Sharp-tailed Grouse

Mining would remove habitat now used by sharptails on Area D. Birds would be displaced from Area D on at least those portions being mined. One dancing ground on the life-of-mine expansion and all of the potential sharptail nesting and brood-rearing habitat would be eliminated. A second dancing ground nearby could be disrupted by the noise and dust of mining. Appropriate timing of disturbance would reduce the chances of disrupting breeding. (See Mitigating Measures.)

Successful reclamation of grassland and shrub-grassland habitats would probably attract grouse. Lush forb growth and cover from grass could encourage use of reclaimed areas for feeding, nesting, and brood-rearing. Western

Energy would try to reestablish one or two sharptail dancing grounds on reclaimed grassland. Sharptails, however, may establish dancing grounds naturally. This occurred in Rosebud Mine's Pit 6, where grouse have attended the independently established lek for 3 years. The nearby Absaloka Mine has also reported a naturally established dancing ground on reclaimed grounds (Michelle Mitchell, Westmoreland Coal Co. biologist, pers. comm., 1984).

Turkey

Mining on Area D would remove habitat now used by turkeys for forage, roosting, nesting, and cover. Turkeys would be displaced to other areas where habitat needs are met. Turkeys would probably not be adversely affected by displacement because flocks continually break up and combine, apparently randomly (Knapp, Montana Department of Fish, Wildlife and Parks, pers. comm., 1983). Other flocks nearby would probably assimilate the displaced birds.

Reclamation of conifer-grassland and shrub-grassland habitats suitable for use by turkeys may take many years. Turkeys would repopulate Area D if stands of ponderosa pine become acceptable for cover, forage, nesting, and roosting. Jonas (1966) suggests that, in southeast Montana, mixed-maturity ponderosa pine stands interspersed with shrub-grassland habitat are ideal for turkeys. However, uncertainties exist about the reestablishment of ponderosa pine. (See Vegetation.)

Waterfowl

Mining and reclamation procedures would eliminate the spoil pond in section 26 of the application area. This pond would be filled, graded, and revegetated to grassland habitat. Reclamation in this instance would eliminate waterfowl habitat.

Songbirds

Mining would remove nesting, roosting, foraging, and escape habitat for songbirds. Birds using Area D would be displaced.

Reclaimed grassland and shrub-grassland would probably attract ground-nesting birds quickly. Tree nesters and species requiring the dense overstory of ponderosa pine might not become reestablished for many years, until the pines are of a suitable size.

Western Energy would take two steps to improve songbird habitat after mining. Cedar posts would be erected in reclaimed areas to encourage use by singing male songbirds during the spring breeding season. In addition, nesting boxes would be erected on additional posts to encourage use by small, cavity-nesting songbirds.

Raptors

Mining would eliminate perching and roosting outcrops and trees, hunting territories, and potential nest sites for raptors. These territorial birds would be displaced and would have to travel far to establish new territories. Nesting prairie falcons one-half mile north of the Area D boundary probably would not be disturbed and displaced. Falcons nesting one-half mile from mining disturbances generally are not displaced (Phillips, Director, U.S. Fish and Wildlife Service Field Station, Sheridan, Wyoming, pers. comm., 1984).

Reclamation of grassland, shrub-grassland, and conifer-grassland habitats would probably attract small mammals and songbirds which could offset some losses of traditional hunting territories for some raptors. It would probably take many years for ponderosa pine to grow large enough to provide roosts, perches, and nest sites.

Nest boxes for American kestrels would be erected near or on reclaimed sites where small mammals (kestrel prey) populations would be expected to increase. An existing highwall south of Area D has had artificial eyries blasted into its face for use by falcons.

Reptiles and Amphibians

Mining would destroy reptile and amphibian habitat. Most individuals would probably be killed. Those not killed would be displaced. Reclamation may encourage increased prey (small mammal) production and some reptile species would probably become quickly established.

Reptiles present before mining would probably eventually return to Area D. If spring flows decrease or are stopped, these springs would be replaced by wells. (See Hydrology.) Stock tanks will provide potential habitat for amphibians.

Threatened and Endangered Species

OSM prepared a biological assessment of the potential impacts of the Area D operation on the peregrine falcon, the bald eagle, and the black-footed ferret. OSM concluded that the proposed action would not affect any of these listed species and the U.S. Fish and Wildlife Service concurred with this conclusion. (See appendix D.)

Contribution of Area D to Rosebud Mine Cumulative Impacts

The impacts of mining on wildlife in the Colstrip area are probably felt by wildlife populations within a larger area around Colstrip. Viewed on a scale the size of the Rosebud Mine 160-square-mile wildlife study area, impacts from individual mining units such as Area D would be hard to measure. Within larger, easily definable blocks of land, such as Montana Department of Fish, Wildlife, and Parks Hunting District 722 or Region 7, the impacts would be almost impossible to detect.

In any case, the pronghorn, deer, sharptails, raptors, and predators would be affected primarily by short-term displacement. Because these species have fairly large home ranges, the impacts of Area D mining to the local (Colstrip area) wildlife populations would not be detectable.

Loss of ponderosa pine habitat (long-term) would force mule deer and turkeys to move to areas where suitable cover exists. These areas may be adjacent to Area D if the carrying capacity of the habitat has not been reached. If adjacent habitats are near carrying capacity, deer and turkeys may have to move long distances or compete for forage with other deer and turkeys. This situation would stress deer and turkeys in the Rosebud Mine area and overuse the available habitat.

Mitigating Measures

Mitigating measures Western Energy could implement are listed below.

(1) Move ponderosa pine snags or telephone poles to reclaimed areas to encourage use by perching and hunting raptors.

(2) Fence reclaimed areas or use repellants as necessary to discourage use of developing shrubs, forbs, grasses, and trees by livestock and big game.

(3) Schedule blasting so that breeding grouse are not disturbed earlier than 1 hour after sunrise.

(4) Establish water catchments for wildlife.

(5) Develop additional microhabitats for small mammals and birds by creating brush piles in reclaimed areas.

(6) Create overflow ponds below stock tanks and fence out livestock so that vegetation may develop.

(7) Leave sediment ponds permanently.

CLIMATE

Mining in Area D would not affect the climate. Particulate emissions would remain at or near ground level, and total emissions would be too small to affect either precipitation or radiation balance.

AIR QUALITY

Summary of Impacts: Total suspended particulate concentrations in the Colstrip area would not change significantly due to mining in either the Area D application area or life-of-mine expansion.

At a production rate of 4 million tons of coal per year, particulate emissions from mining in Area D would total 585 tons annually (table III-5). The major emission sources would be overburden removal and haul truck and scraper operations. These activities would account for about 85 percent (497 tons) of the total annual particulate emissions. No other activity would emit more than 45 tons of particulate per year (table III-5). Coal dust emissions would be insignificant.

The particulate emissions from mining in Area D would have only a small effect on total suspended particulate (TSP) concentrations in the Colstrip area. TSP concentrations would increase adjacent to active mining in Area D, but would decrease to the south in the Area E vicinity. Annual average TSP concentration isopleths for the Colstrip area are shown in figure III-1. Figure III-2 depicts the increases (solid line) and decreases (dashed line) in TSP concentration as Western Energy shifts its mining operation from Area E to Area D and mines Area C.

EMPLOYMENT AND INCOME

Summary of Impacts: The jobs provided by mining over the life of Area D would replace those phased out in Area E. No new jobs would be created

Western Energy would transfer the workers now in Area E to Area D. Employment would not grow above current capacity levels, since jobs otherwise terminated at Area E would be continued in Area D.

Assuming that employment is perfectly proportional to production, the coal mined from Area D would, over 23 years, account for about 29 percent of the jobs at the Rosebud Mine (table III-6). Employment at the mine, when operating at planned capacity, is expected to be about 500 jobs through the rest of the 1980s and early 1990s. By 1986, total mine employment is planned to drop and stabilize at 400 jobs through 2007. The proposed Area D production would support 122 to 150 of these jobs during capacity operations.

Because of the recent recession, and for various other reasons, layoffs have occurred at the Rosebud Mine. Current employment is approximately 332 workers, 168 below the mine's projected total at peak capacity. The proposed expansion of the mine into Area D would allow the continuation of a sizable and integral portion of the county's economy. The nonmine employment supported by the Area D workers would remain concentrated in Forsyth and Colstrip. The economies of the communities are now adjusting to the scaling back of construction activity in the area and settling into a period of more stable employment. Other nearby communities, such as Lame Deer and Ashland, would not be affected by Area D.

Workers in Area D would earn an average of about $33,792 per year, in 1984 dollars. The total payroll of the Area D operations would be about $101.4 million.

TABLE III-5

Controlled and Uncontrolled Particulate
Emissions From Area D

Activity	Extent of Activity Per Year	Emission Factor	Coal Dust	Uncontrolled Emissions (tpy)	Controlled Emissions (tpy)	% Control	Control Method
Topsoil removal	2,990 scraper hours/yr	16.0 lb/scraper hour	No	24	24	0	
Overburden drilling	4,371 holes/yr	1.5 lb/hole	No	3	3	0	
Overburden blasting	383 blasts/yr	50.0 lb/blast x 0.75	No	7	7	0	
Overburden removal							
Dragline	16,000,000 yd^3	(.75)(.04 lb/yd^3)	No	240	240	0	
Scrapers	9,259 hrs/yr	32.0 lb/mach/hr	No	148	74	50	Watering
Coal drilling	9,649 holes/yr	0.22 lb/hole	Yes	1	1	0	
Coal blasting	124 blasts/yr	(.75)(35 lb/blast)	Yes	4	4	0	
Coal removal	4.0×10^6 tons/yr	0.003 lb/ton	Yes	4	4	0	
Haul road construction	5,660 hrs/yr	32 lb/mach/hr	No	91	45	50	Watering
Haul roads (haulers)	188,000 VMT*	7.48 lb/VMT	No	703	107	85	Magnesium chloride
Haul roads (scrapers)	40,000 VMT	7.48 lb/VMT	No	150	76	50	Watering
Access roads (lt. duty)	1,800 VMT	3.01 lb/VMT	No	3	0	85	Magnesium chloride
Wind erosion	106 acres	0.02 tons/acre/yr	No	2	2	0	

Source: Western Energy Company, 1984b.
VMT=vehicle miles traveled

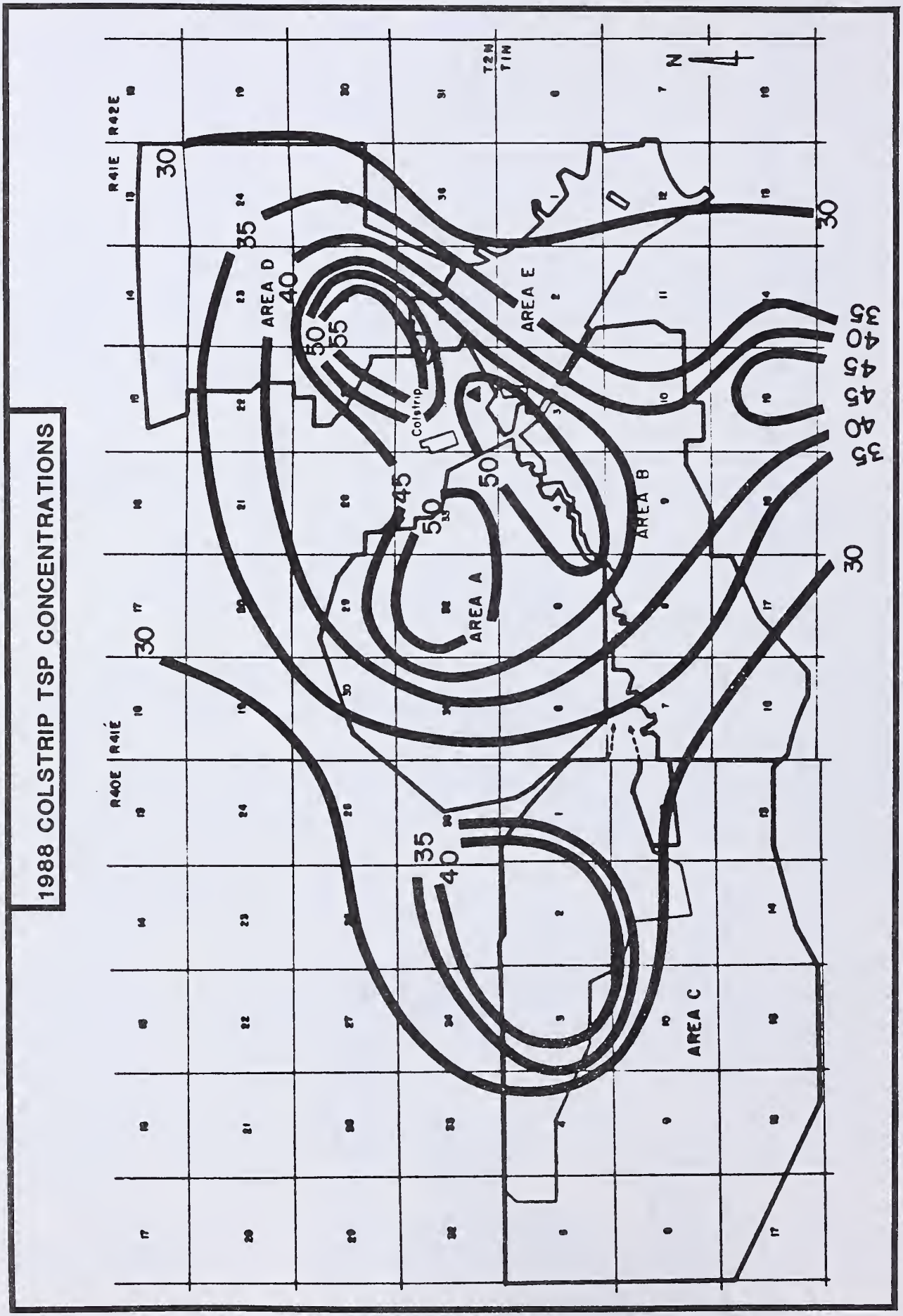

FIGURE III-1

Isopleth lines drawn for the Rosebud Mine show projected levels of total suspended particulate (TSP), measured in micrograms per cubic meter. The lines indicating the highest concentrations surround the mining areas. The levels shown include background TSP levels, or the amount of TSP that would be present even without any mining. Most of the TSP is dust.

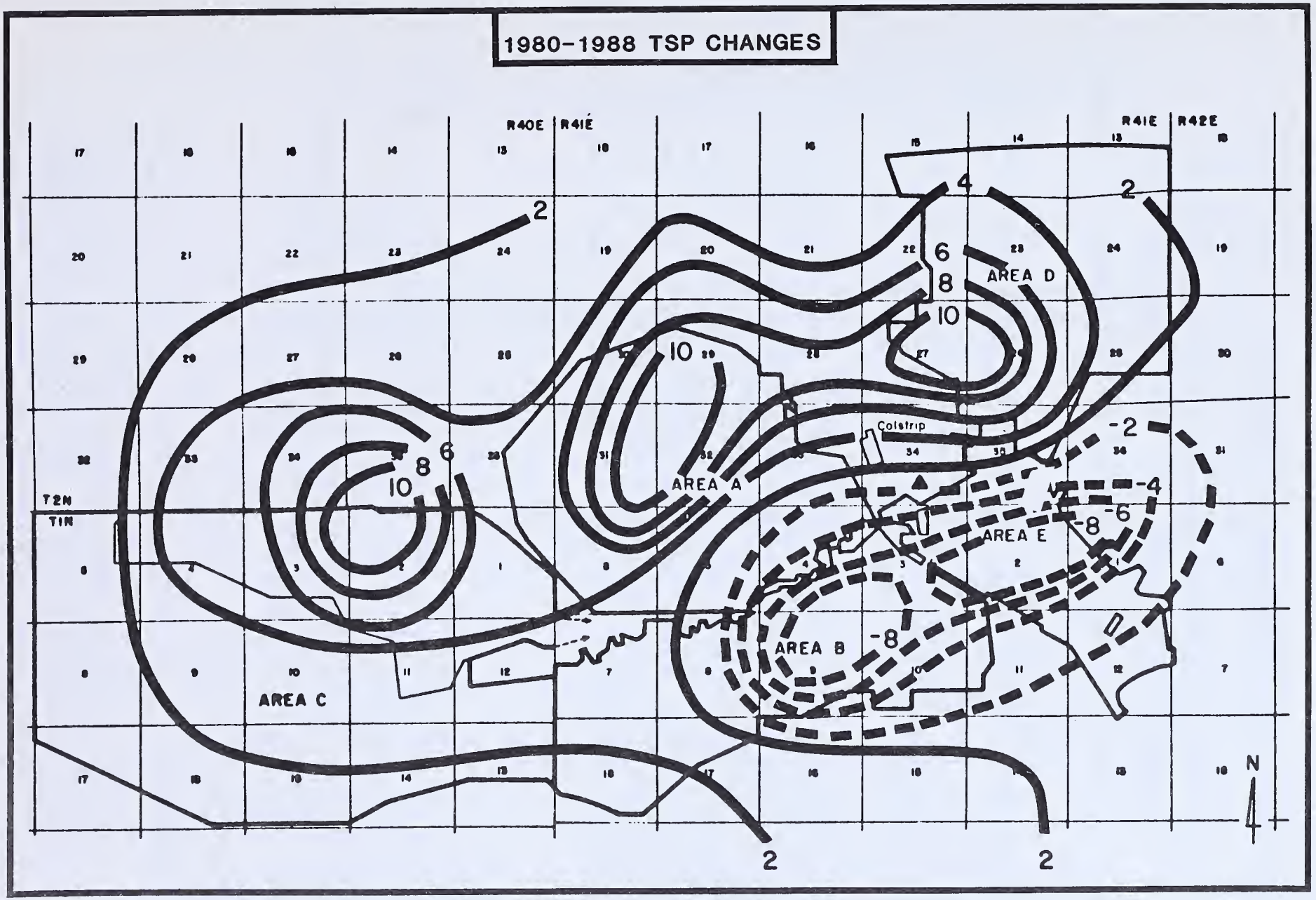

FIGURE III-2

Isopleth lines show the increase and decrease of total suspended particulate during the decade. TSP levels are projected to increase in Areas A, C, and D, and decrease in Areas B and E. The changes coincide with the start-up or shutdown of mining in each area.

TABLE III-6

Projected Rosebud Mine Employment and Coal Production
1985-2007

	Area D		Rosebud Mine	
Year	Production (tons x 10^6)	Employment	Production (tons x 10^6)	Employment
1985	2.0	71	14.0	500
1986	4.0	127	15.8	500
1987	4.0	122	16.4	500
1988	4.0	122	16.4	500
1989	4.0	124	16.1	500
1990	4.0	124	16.1	500
1991	4.0	124	16.1	500
1992	4.0	124	16.1	500
1993	4.0	124	16.1	500
1994	4.0	124	16.1	500
1995	4.0	124	16.1	500
1996	4.0	124	15.2	472
1997	4.0	150	10.7	400
1998	4.0	150	10.7	400
1999	4.0	150	10.7	400
2000	4.0	150	10.7	400
2001	4.0	150	10.7	400
2002	4.0	150	10.7	400
2003	4.0	150	10.7	400
2004	4.0	150	10.7	400
2005	4.0	150	10.7	400
2006	4.0	150	10.7	400
2007	1.8	67	10.7	400
Total	87.8		292.1	

Source: Chuck Rose, Western Energy Company, pers. comm., May 17, 1984.
Note: Table figures represent proposed employment. Current employment and production for the mine as a whole are significantly less.

SOCIAL CONDITIONS

Summary of Impacts: Since Area D would not create new jobs, it would not increase the population of Rosebud County, Colstrip, or Forsyth. The population of Rosebud County, Colstrip, and Forsyth peaked in 1982 and 1983. It

is projected to decline through 1986 and remain relatively stable thereafter. The population attributable to Area D would account for approximately 30 percent of all direct coal-related population in Rosebud County. Area D employment would contribute to the stability of Colstrip's social life, especially during the period of population decline after the completion of Colstrip Generating Units 3 and 4.

Population

The populations of Rosebud County, Colstrip, and Forsyth peaked in 1982 and 1983 and have started to decline. The decrease is projected to stop in the mid-1980s and be followed by a period of population stability. The rapid decline in 1983 resulted from the decrease in construction jobs following completion of Colstrip Generating Units 3 and 4 and not from a decline in mining employment. Area D employment would begin in 1985 with 71 employees producing 2.0 million tons of coal. Employment would rise to 122 in 1986.

The population stemming solely from Area D would not contribute substantially to population increases or decreases in Rosebud County, Colstrip, or Forsyth. Instead, Area D would moderate the possibility of additional population decline following 1983 and would add to the stability of the population base well into the next century. Area D employment and related population would make up 2 percent of the county population in 1985 and 5 percent in 2000; 10 percent of Colstrip in 1985 and 11.8 percent in 2000; and 2 percent of Forsyth in 1985 and 3 percent in 2000. Area D's contribution to any of these populations would cease after 2007, the end of Area D mining. After 2007, the Area D employees are expected to work in another part of the Rosebud Mine.

Social Life

The extension of Area D would not adversely affect the social conditions in Colstrip. The miners and families now living in Colstrip and the surrounding area would continue to live there. These people would be in the area during the 1985-2007 period, thereby contributing to Colstrip's long-term stability. As long-term, permanent workers, they would be integrated into the community's social, economic, and political life.

SOCIAL AND COMMUNITY SERVICES

Summary of Impacts: The strain placed on Colstrip's and Rosebud County's social and governmental services in the past is over. Service expansions and improvements coupled with a declining construction population have combined to create a service system sufficient for the area's needs. Each community service has idle capacity and could absorb

additional clients. The population related to Area D already resides in the area and does not constitute a new population to be served.

Law enforcement, fire protection, water supply, sanitation, social welfare, education, and medical services are adequate for the needs of Colstrip and Rosebud County. Service improvements or expansions funded by Sunlight Development, the Montana Coal Board, private investors, and local government have been completed. Colstrip's utilities, schools, and governmental facilities are new. Virtually all have been built since 1970 and can serve the town's projected long-term population of 3,500, with extra capacity for 1,500 more residents. Colstrip's basic service infrastructure is the most modern in the state; Forsyth's and Rosebud County's infrastructures are not far behind.

The housing shortage that affected the entire county is now past. There is surplus housing in Colstrip today as the population declines along with the completion of Unit 4.

The permitting of Area D would not have adverse effects on the provision of social and governmental services, since both the population and service systems are in place and effectively paid for.

FISCAL CONDITIONS

Summary of Impacts: Mining would generate $304.6 million in tax revenues for local school districts and county, state, and federal governments over the life of Area D.

At 1983 coal prices and tax rates, the 87.8 million tons of estimated coal production from all of Area D would provide:

- $201.2 million in state severance taxes
- $ 37.6 million in federal black lung excise taxes
- $ 30.7 million in federal abandoned mine reclamation taxes
- $ 31.7 million in local property taxes
- $ 3.4 million in state resource indemnity trust taxes

The actual amounts paid would depend on the price and tax rates in effect at the time of mining. (See appendix A, tables A-7 and A-8.)

The state of Montana would receive the largest share (72 percent) of tax revenues generated from Area D, including all of the state severance tax, about half of the federal abandoned mine reclamation taxes, a small part of the property tax, and all of the resource indemnity trust tax. The federal government would receive about 17 percent. Rosebud County and the Colstrip school districts would receive about 10 percent.

LAND USE

Summary of Impacts: Mining of the Area D application area and life-of-mine expansion would temporarily suspend grazing on a maximum of 2,110 acres of rangeland and eliminate wheat and hay production on approximately 120 acres. These impacts would be minor.

Western Energy would eliminate crop production on the Area D application area. Approximately 64 acres of winter wheat and 56 acres of hay land would be destroyed and not replaced, resulting in a yearly loss of 2,112 bushels of wheat and 56 tons of hay. Another 7 acres of cropland would be eliminated in the life-of-mine expansion, slightly increasing the loss of hay and wheat.

Mining would temporarily suspend grazing on the lands being mined. The maximum amount of grazing lost would be 18 years for 80 cow-calf units in the application area and 5 more years for 30 cow-calf units in the life-of-mine expansion. The actual loss in grazing, however, probably would be less, because livestock would graze reclaimed areas within 3 to 5 years after revegetation.

TRANSPORTATION

Summary of Impacts: Area D would not noticeably change either train or highway traffic levels in Rosebud County.

Highway traffic has been declining since Unit 3's completion. After 1985, the total amount of road traffic due to the entire Rosebud Mine is projected to remain relatively constant. Highway traffic due to Area D would vary with the coal production level, ranging between 28 and 58 vehicle trips per day. Based on the location of the homes of workers, about 95 percent of the highway traffic would be concentrated on the segment of FAP 39 north of Colstrip; less than 5 percent of the traffic would be on FAP 39 south of Colstrip; and a few trips per day would be on the graveled secondary roads leading to Colstrip (Clete Daily, President, Clete Daily and Associates; Bill Cloud, Traffic Planner, Montana Director of Highways, pers. comm., August 16 and September 7, 1984).

Train traffic due to production from Area D would average between two and four coal trains per day (loaded and empty) over the life of the mine, assuming that all coal was shipped from the area and not consumed at the generating plants.

RECREATION

Summary of Impacts: Since Area D would not increase population, no impact on recreation facilities or sites in or near Colstrip is expected.

All Colstrip recreational facilities are now used at or below capacity and are considered adequate to serve the existing population. The completion of Stillwater Park in 1983 greatly enlarged outdoor recreational opportunities.

Recreation sites and facilities outside Colstrip would not be affected by Area D. Those sites and facilities, including Tongue River Reservoir and the Ashland Division of Custer National Forest, can accommodate more use. The removal of the lands to be mined in Area D would have no effect on recreation, since the land is now closed to public use (Montana Department of State Lands, 1983).

CULTURAL RESOURCES

Summary of Impacts: One prehistoric site eligible for listing on the National Register of Historic Places has been salvaged and would not be further affected by mining in the application area. Six additional sites are potentially eligible for the National Register of Historic Places and may be destroyed by mining in the life-of-mine expansion.

One prehistoric site in the buffer zone of the application area has been salvaged to mitigate further loss of information. Three potentially eligible sites lie west of the highway in the buffer zone and would not be affected.

Six potential National Register sites may be destoyed in the life-of-mine expansion. Until a detailed mine plan is submitted for the expansion, it is unclear which sites would be directly affected. These sites will be evaluated further and properly mitigated prior to mining. All other sites in the application area and life-of-mine expansion have been adequately recorded and require no further work. An unknown number of additional sites may exist in the buffer zone of the life-of-mine expansion. Access to this zone will be necessary before mining so that sites can be recorded and evaluated for National Register listing. Mitigation plans would be developed after each site is evaluated.

AESTHETICS

Summary of Impacts: Western Energy's operations would initially destroy the landscape of the mine area. After mining, reclamation would blend the minesite with surrounding lands. In the long term, as ponderosa pine woodlands regrow, aesthetic impacts would not be significant.

Mining in the application area would destroy 2,615 acres of landscape over 18 years. Another 850 acres would be destroyed in the life-of-mine expansion, bringing the total disturbed area to 3,465 acres over 23 years. This area would make up about one-sixth of the total acreage disturbed at the Rosebud Mine.

During mining, the landscape of Area D would resemble other parts of the Rosebud Mine. Ridges of excavated overburden (spoil) would snake from one side of the mine area to the other. Coal trucks, scrapers, graders, and other machinery would travel the many roads built in and around the mine workings. The dragline's towering boom would sweep back and forth, scooping up and dumping overburden. Blasting would send noise and shock waves into the otherwise quiet setting. Overall, the operation would contrast sharply with surrounding undisturbed lands.

Mining's impact on the landscape would be visible from many points in and around Colstrip. The people most affected by the operation would probably be the residents of two housing developments just west of the life-of-mine expansion boundary. Although the residents would be familiar with strip mining, having the sights and sounds of a mine operation as close as 1,000 feet from home may be considered unpleasant. To other Colstrip residents, the visual impact of Area D would probably be insignificant. Similar sights and sounds prevail throughout the area.

Although Western Energy would disturb 3,465 acres, not all lands would be disturbed at once. The company plans to reclaim each year about the same number of acres disturbed. At the end of mining, the reclaimed lands would have reached various stages of recovery, slowly growing toward a more natural condition, similar to surrounding lands.

Following mining, the disturbed land would be contoured into gentler slopes, with fewer knolls, ridges, coulees, and gullies, than the topography of the premining landscape. The most noticeable change would be the absence of ponderosa pine woodlands. These would take decades to regrow. Once this happens, the minesite would contrast little with unmined lands.

The reclaimed lands would have less diverse vegetation, provide less interesting scenery, and may lack the appeal of unmined lands. But the topography and plants would be similar to what existed before mining. No distinctive or unusual features would be lost. In the long term, the aesthetic impacts would not be significant.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Western Energy proposes to mine 87.8 million tons of coal over 23 years in Area D; 5.6 million tons of Rosebud coal and 30 million tons of McKay coal would not be recovered from the area, owing to limitations on present technology and a lack of markets for the McKay coal.

At an average annual coal production rate of 3.8 million tons, about 3.2 million gallons of diesel fuel and 18 million kilowatt-hours of electricity would be used in Area D each year. Total direct energy used to mine and ship the coal would reach as high as 7 percent of the energy equivalent of the electricity generated from the coal.

Area D would use an average of roughly 90 acre-feet of water per year. A majority of this water would be lost to evaporation and therefore would not be available for other uses downstream, such as agriculture. The population associated with the mine would require an average of about 93 acre-feet of water per year.

The topography of Area D would be modified during mining, but the final topography would approximate the premining topography and would be suitable for the proposed postmining land use. The existing stratigraphy of the Rosebud overburden would be permanently altered; however, the stratigraphy is not unusual or intrinsically valuable.

Ground water passing through the mine spoil would, for at least several hundred to thousands of year after mining, be of poorer quality than existed prior to mining. Five wells and three seeps in the application area would be removed. These good quality, overburden-fed water sources would be permanently lost. Three additional springs, Nos. 23, 24, and 26, located outside the mine area might have decreased flow or diminished water quality as a result of mining.

The company would replace four of the wells and one spring (No. 23) with three sub-McKay wells. The fifth well, which is unused, would be removed. The replacement wells would provide more water but require more maintenance than springs. In addition, the sub-McKay aquifer is of poorer quality than the overburden aquifer, although the water would be suitable for the postmining land use.

During mining, grazing in Area D would be temporarily suspended. Crop production during and after mining would be permanently eliminated, unless postmining landowners converted reclaimed rangeland to cropland.

The spoil pond in section 26, a site of aquatic wildlife habitat, would be lost. In addition, rock outcrops would be destroyed, and any potential raptor nest sites on them would be lost.

Six cultural resource sites would be destroyed by mining. An additional site would probably be degraded by theft and vandalism. All seven sites would probably be excavated and analyzed before mining, preserving the information contained in the sites.

SHORT-TERM USES VERSUS THE PRODUCTIVITY OF THE HUMAN ENVIRONMENT AFTER MINING

Coal from Area D would produce electricity and considerable tax revenues royalties, and jobs. These benefits would continue throughout the life of Area D at a cost of short-term soils, wildlife, and livestock productivity.

Mining would not decrease the long-term productivity of the soils or the value of the land for recreation, scenery, or livestock production. Nor would mining decrease long-term surface water quality or quantity, or ground water supplies. Ground water quality, however, would decrease. Affected waters would be suitable for stock and wildlife watering, but would not be suitable for domestic or irrigation use.

Over both the short and long term (5 or more years), the rangeland productivity of the mined area would probably exceed premining levels. However, species diversity and the complex premining vegetation mosaic would be lost for several decades.

In the short term, wildlife habitat on Area D would be disrupted or destroyed. This would eliminate use of the land by wildlife. However, some species with small home ranges (such as song birds and small mammals) could use some sites not yet stripped of vegetation and would return quickly to reclaimed areas. Reclamation of ponderosa pine woodlands to suitable wildlife habitat may take up to 50 years. In the meantime, wildlife requiring this habitat would not return to the reclaimed area.

Over the 23-year life of Area D, Western Energy would pay a total of about $305 million in taxes. These revenues would help finance schools, both in Rosebud County and elsewhere in the state, and would pay for other state local, and federal government expenses.

Chapter IV

REJECTION OF THE APPLICATION

After reviewing Western Energy Company's mining and reclamation plan, the Department of State Lands and Department of the Interior must take one of the four alternatives listed in the introduction: (1) approve the application as proposed, (2) reject the application, (3) selectively reject the application, or (4) approve the application with special conditions.

Chapter III described the impacts of approving the application as proposed. The impacts of the last two alternatives, selective rejection and approval with conditions, would be less than approval as proposed but more than rejection.

The following analysis has been written to illustrate the effects of rejection. For the analysis in this chapter, several assumptions have been made. These do not indicate the intentions of the Department of State Lands or Office of Surface Mining; they simply provide a base from which to project impacts. The analysis assumes that (1) the application for Area D and any future amendments (such as for the life-of-mine expansion) are rejected, (2) Western Energy Company does not replace the coal lost in Area D (3.8 million tons per year for 23 years), and (3) all future applications for extensions of existing mines are approved, including applications for Rosebud Mine Areas B and C.

EFFECTS ON THE PHYSICAL ENVIRONMENT

Rejection of the application and any life-of-mine amendment would leave 87.8 million tons of Rosebud coal in the ground. The overburden that lies above the coal seam, as well as the landscape, surface waters, vegetation, and soils would remain undisturbed.

Rejection of the application would prevent the destruction of three seeps in the mine area and the projected 2- to 3-percent increase in total dissolved solids in Cow Creek (in section 36, T2N, R42E). Rejection would also prevent the 6-percent decrease in flow to spring No. 24 and the decrease of alluvial ground water flow in upper Pony Creek.

Rejection would leave the topographic diversity and drainage networks unchanged. Rejection would also probably prevent the reclamation of 369 acres of unreclaimed Northern Pacific spoil.

Total suspended particulate concentrations near Area D would remain unchanged if the application is rejected. The total effect on Colstrip would be small. Air quality would remain essentially as described in chapter II.

The destruction of wildlife habitat by mining would mostly be temporary if reclamation is successful. Even so, the 3,465 acres of habitat now contained within the Area D disturbance area would not be destroyed if the application is rejected. Included in the area not destroyed would be 800 acres of ponderosa pine forest, for which long-term reestablishment success is uncertain.

Rejection of the application would stop the destruction of the cultural resource sites found within the disturbance area.

EFFECTS ON THE SOCIAL AND ECONOMIC ENVIRONMENT

The size of the annual average work force for Area D would be 130. Rejection of the application would eliminate 130 jobs, about 30 percent of the jobs at the Rosebud Mine during full employment. Elimination of these jobs would have a number of effects. Western Energy Company would be forced to lay off as many as 130 employees. Union contracts have seniority provisions, so the most recently hired employees (those hired to work in Area C) would be laid off first. Any recent gains by Northern Cheyenne workers in mine employment would be jeopardized.

The population of the Colstrip area would be reduced by rejection of the application. Moreover, the population stemming from Area D employment would not exist to have a stabilizing effect on social life when Colstrip's population declines following the completion of Cenerating Unit 4.

Housing and medical services in Colstrip are projected to be more than adequate for the foreseeable future. Rejection of the application would have no effect on some services and would increase the surplus of others.

Part of the coal mined in Area D would be shipped by train north on the Burlington Northern Railroad. Rejection of the application would reduce train traffic on the Colstrip spur by an average of one to two trains per day.

APPENDIXES

Socioeconomic Tables--Appendix A
Common and Scientific Names of Wildlife--Appendix B
Cumulative Impacts of the Rosebud Mine--Appendix C
OSM Biological Assessment--Appendix D

TABLE A-1
Rosebud County Historical Employment and Income, 1970, 1975, and 1977-1982

	1970	1975	1977	1978	1979	1980	1981	1982
Total employment	2,517	5,178	4,162	4,246	4,349	5,018	5,720	6,999
Total personal income by place or residence	$16,731	$47,398	$48,505	$55,713	$61,370	$77,356	$97,627	$120,233
Total per capita income	2,768	4,873	4,570	6,208	6,314	7,699	8,921	9,879
Montana per capita income	3,395	5,419	6,161	7,076	7,633	8,361	9,245	9,544

Source: U.S. Bureau of Economic Analysis, Annual.

TABLE A-2

Rosebud County and Montana Historical Unemployment, 1970-1983

	Montana		Rosebud County	
	Number	Percent	Number	Percent
1983	35,000	8.8	711	8.8
1982	34,000	8.6	478	6.3
1981	27,000	6.9	432	7.1
1980	22,000	6.0	284	5.4
1979	19,000	5.1	231	5.0
1978	22,000	6.0	264	5.9
1977	22,000	6.4	271	6.9
1976	20,000	6.1	259	5.8
1975	20,614	6.4	169	3.3
1974	16,724	5.2	118	3.6
1973	14,619	4.8	100	3.2
1972	13,882	4.8	85	3.2
1971	13,502	4.8	81	3.0
1970	11,850	4.3	84	3.1

Source: Montana Department of Labor and Industry, monthly.

TABLE A-3

Rosebud County Historic Population Trends

Year	Population	Year	Population	
1980	10,000	1982	10,700	
1970	6,032	1981	10,600	
1960	6,187	1980	9,899	Census
1950	6,570	1979	9,700	
1940[1]	6,477	1978	9,700	
1930	7,347	1977	10,500	
1920	8,002	1976	9,900	
1910	7,985	1975	8,600	
		1974	7,700	
		1973	6,600	
		1972	6,300	
		1971	6,100	
		1970	6,032	Census

Source: U.S. Bureau of the Census, 1980.

[1]County population declined between 1910 and 1940 as a result of county splitting followed by the economic effect of the drought and the Great Depression.

TABLE A-4

Selected Population Projections for Rosebud County, 1980-2000

	Colstrip High School Grant Application 1978	Area E Extension EIS 1981	Area C EIS 1982	Rosebud Mine Comprehensive EIS 1983	Area B Extension EIS 1983	Montana Coal Board Preliminary 1984
1980±15,436	10,800	11,379	NA	10,000		
1981	15,185	NA	12,945	12,945	NA	10,900
1982	13,232	NA	15,974	16,245	NA	12,170
1983	10,999	12,700	15,699	16,419	16,059	12,565
1984	10,471	NA	13,038	13,724	14,866	12,037
1985	10,552	NA	11,527	12,191	12,550	12,003
1990	10,680	13,900	11,218	11,842	11,671	NA
1995	NA	NA	11,420	12,073	NA	NA
2000	NA	NA	11,608	12,245	NA	NA

U.S. Census 1980 = 9,899

Source: Montana Department of State Lands, 1983.
Montana Coal Board, 1984.

TABLE A-5

Colstrip School Enrollment, September 1984

Class Size Accreditation Standard	Isabelle Bills School		Pine Butte School	
	Enrollment	Available Capacity	Enrollment	Available Capacity
K = 24	K = 14	10	K = 16	8
	K = 14	10	K = 16	8
	K = 16	8	K = 13	11
			K = 19	5
First = 26	First = 19	7	First = 17	9
	First = 20	6	First = 19	7
	First = 21	5	First = 18	8
Second = 26	Second = 22	4	Second = 25	1
	Second = 20	4	Second = 22	1
			Second = 25	0
Third = 28	Third = 14	14	Third = 23	5
	Third = 15	13	Third = 22	6
	Third = 15	13	Third = 24	4
Fourth = 28	Fourth = 16	12	Fourth = 19	9
	Fourth = 18	10	Fourth = 20	8
	Fourth = 18	10	Fourth = 18	10
Fifth = 30	Fifth = 20	10	Fifth = 25	5
	Fifth = 22	8	Fifth = 24	6
Total	284	144	365	111

Source: Colstrip School District #19.
Note: for the Colstrip Middle and High Schools the accreditation standard is 30 students per class, except for chorus, instrumental music, and typing. The curriculum is departmentalized by subject area. Class sizes range from 3 to 35.

TABLE A-6

Annual Coal Board Grant Awards
Rosebud County, 1976-1984

Year	Amount
1976	$ 4,579,283
1977	2,952,927
1978	911,724
1979	206,570
1980	7,181,391
1981	1,391,000
1982	1,302,723
1983	3,826,595
1984[1]	1,875,839
Total	$24,228,324

Source: Montana Coal Board, 1984

[1]Through June 1984.

TABLE A-7

Annual Coal Production in Rosebud County, 1980-1983 (in tons)

Year	Peabody Coal	Western Energy	Total
1983	2,558,854	9,573,670	12,142,524
1982	2,480,753	9,446,592	11,927,345
1981	3,153,085	10,386,728	13,539,813
1980	2,943,006	10,448,628	13,391,634

Source: Montana Department of Revenue, Annual.

TABLE A-8

Contract Sales Price, Western Energy Coal Company, 1980-1984

Year	Production (millions of tons)	Price/ton[1]	Contract Sales (millions of dollars)
1983	9.57	$7.64	$73.12
1982	9.45	7.11	67.20
1981	10.39	6.35	65.92
1980	10.45	5.05	52.73

Source: Montana Department of Revenue, Annual.

[1]Weighted quarterly average.

APPENDIX B

Scientific Names of Wildlife Referred to in Wildlife Text

Mule deer	*Odocoileus hemionus*
White-tailed deer	*Odocoileus virginianus*
Pronghorn	*Antilocapra americana*
Coyote	*Canis latrans*
Red fox	*Vulpes fulva*
Badger	*Taxidea taxus*
Raccoon	*Procyon lotor*
Bobcat	*Felis rufus*
Cottontail	*Sylvilagus* sp.
White-tailed jackrabbit	*Lepus townsendii*
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*
Porcupine	*Erethizon dorsatum*
Deer mouse	*Peromyscus maniculatus*
Prairie vole	*Microtus ochrogaster*
House mouse	*Mus musculus*
Western harvest mouse	*Reithrodontomys megalotis*
Sharp-tailed grouse	*Pediocetes phasianellus*
Merriam's turkey	*Meleagris gallopavo*
Ring-necked pheasant	*Phasianus colchicus*
Sage grouse	*Centrocercus urophasianus*
Hungarian partridge	*Perdix perdix*
Mallard	*Anas platyrhynchos*
American widgeon	*Anas americana*
Northern shoveler	*Anas clypeata*
Blue-winged teal	*Anas discors*
Brewer's sparrow	*Spizella breweri*
Lark sparrow	*Chondestes grammacus*
Vesper sparrow	*Poocetes gramineus*
Western meadowlark	*Sturnella neglecta*
Lark bunting	*Calamospiza melanocorys*
Black-capped chickadee	*Parus atricapillus*
Red-breasted nuthatch	*Sitta canadensis*
Rufous-sided towhee	*Pipil erythrophthalmus*
Chipping sparrow	*Spizella pallida*
American robin	*Turdus migratorius*
Common flicker	*Colaptes auritus*
Red-headed woodpecker	*Melanerpes erythrocephalus*
Pine siskin	*Carduelis pinus*

Red-tailed hawk	*Buteo jamaicencis*
Northern harrier	*Circus cyaneus*
Rough-legged hawk	*Buteo lagopus*
Cooper's hawk	*Accipiter cooperii*
Prairie falcon	*Falco mexicanus*
Prairie rattlesnake	*Crotalus viridis*
Bull snake	*Pituophis melanoleucus*
Garter snake	*Thamnophis* sp.
Racer	*Coluber constrictor*
Snapping turtle	*Chelydra serpentina*
Painted turtle	*Chrysemys picta*
Rocky Mountain toad	*Bufo woodhousei*
Sagebrush lizard	*Sceloporus graciosus*
Chorus frog	*Pseudacris triseriata*
Leopard frog	*Rana pipiens*
Tiger salamander	*Ambystoma tigrinum*
Bald eagle	*Haliaeetus leucocephalus*
Peregrine falcon	*Falco perigrinus*
Black-footed ferret	*Mustella nigripes*
Whooping crane	*Grus americana*
Grizzly bear	*Ursus arctos*
Northern Rocky Mountain wolf	*Canis lupus*

APPENDIX C

Cumulative Impacts of the Rosebud Mine

The Rosebud Mine comprises 6 parts: Areas A, B, C, D, E, and Pit 6. In March 1983 the Montana Department of State Lands and the U.S. Office of Surface Mining issued a comprehensive environmental impact study analyzing the impact of the entire mine. Of primary importance to the study was an evaluation of the cumulative impacts of mining, that is, the effects of all mine areas together. After distribution of the draft study, the public was given 60 days, until May 9, to comment. The agencies then issued a final comprehensive study (Montana Department of State Lands and U.S. Office of Surface Mining, 1983a). Below is a summary of the impacts contained in that document. (Copies of the document are available from the Department of State Lands, Capitol Station, Helena, Montana 59620.)

Geology: Geologic impacts would be minor. In all areas to be mined, the stratigraphy would be disrupted by removal of the Rosebud coal, and the lower quality McKay and Stocker coal seams would become uneconomic to recover. The topography would become smoother and slightly lower. In some areas, minor gullying, settlement, or piping might occur. Overburden mixing would slightly decrease electrical conductivity in near-surface material and might locally increase overburden chemical components commonly found in deeper, undisturbed layers.

Hydrology: Ground water aquifers would be disrupted by mining and replaced with spoil aquifers that would have flow characteristics similar to the original aquifers. During mining in each area, the flow of ground water would be intercepted by the pits. Ground water discharging to the pit would be at a maximum immediately after the pit is opened and would diminish with time. Water levels in the replaced spoil would eventually reach premining levels.

The reestablished spoil aquifer would have approximately twice the concentration of total dissolved solids of the premining Rosebud coal and overburden aquifers. Spoil water flow would follow the regional southeastern flow direction, eventually reaching Cow Creek and East Fork Armells Creek. Spoil water discharging at the boundaries of the mined areas to streams could have an appreciable effect on surface water quality during low flow. In addition, ground water in undisturbed valley fill along the East Fork of Armells Creek and Cow Creek would gradually be displaced by spoil water, increasing the concentration of total dissolved solids. The quality of water in aquifers underlying the Rosebud coal, however, would not be appreciably affected by mining or replacement of spoil.

Seepage from the existing and proposed mine areas and industrial ponds will continue to affect surface and ground water quality and quantity near Colstrip. Increases in salinity and alluvial ground water could have detrimental impacts on Cow Creek and East Fork Armells Creek. In the long term, vegetative communities in the bottom of these creeks around Colstrip may change in response to fluctuations in water levels and increased dissolved solids.

The probable impacts to the surface water over time would include a decrease in the total volume of runoff from the mined areas, a reduction of peak flow magnitudes, the near-total removal of sediment from water of peak flow magnitudes, and the near-total removal of sediment from water introduced to the streams from the mined areas, all due to the placement of sediment ponds. Sediment ponds may also cause an episode of high erosion upon removal, although these episodes would be localized and insignificant.

Climate: Mining would have no impact on the climate of the area.

Air Quality: The levels of fugitive dust in the Colstrip area would not change significantly due to mining; however, areas having increased dust emissions would shift: dust levels would decrease in Areas E and B and increase in Areas A, C , and D. Because of the large size of the dust particles, little impact to human health is expected. The reduction in visibility due to dust levels would be minor.

Noise: Noise from the mine would reach an increasingly larger area. Noise in quiet areas away from Colstrip would probably increase as a result of more frequent coal shipments and additional blasting. Sound levels within Colstrip would not increase dramatically, because sound levels are already high.

Soils: Soils of the areas to be mined would become mixed and their chemical and physical properties would be partly altered. Soil mixing and the loss of discrete soil types would reduce the postmining potential for crop production, especially in Area C. The potential for successful establishment of warm-season grasses and ponderosa pine would also be lowered due to soil mixing. Soil availability may be limited in Area A. For all disturbed soils, bulk densities of soils could increase; organic matter would decrease; and nutrient cycling in the soil would take a number of years to reach equilibrium.

Vegetation: Impacts to vegetation would include the temporary disruption of vegetative cover on areas as they are prepared for mining. Reestablished vegetation would be dominated by cool-season grasses and legumes, representing a probable reduction in seasonal diversity from the premined vegetation. Cropland and pasture areas would be replaced with native grasses and legumes. Areas with a high proportion of conifer forest types would also be replaced with native grasses and legumes. Some loss of riparian habitats may occur, especially where East Fork Armells Creek is to be mined. It is likely that warm-season grasses would decrease in postmined areas, and shrub cover would also decrease. The regrading and revegetation of old spoil remaining from operations in Areas D and E will bring land back into rangeland production that previously had limited usefulness.

Wildlife: Wildlife habitats would be temporarily destroyed by mining. Some of these habitats, due to the altered character of the reclaimed area, would not be replaced. One golden eagle nest, one prairie falcon nest, and four sharptailed grouse dancing grounds would be disturbed by mining, and successful reestablishment is uncertain. Riparian areas along East Fork Armells Creek would be disrupted, although no regional population impacts are expected to occur.

The significant reduction of ponderosa pine and shrub habitat proposed in the reclamation plans would reduce the potential area for deer and pronghorn antelope wintering and would change the species composition of small mammal and songbird populations. These, in turn, may affect predators. Waterfowl, reptiles, amphibians, and fish would not be significantly affected.

Sociology and Economics: The population of Rosebud County (9,899) is expected to increase by about 61 percent between 1980 and 2010. Nearly 11 percent of that increase will result from the Rosebud Mine. The largest expected increases will begin in the mid-1990s. Much of that increase will be in Colstrip. The percentage of the county's total population resulting from the Rosebud Mine will vary from a high of 14 percent in 1990 to 10 percent in 2010. Per capita income is expected to increase. The proposed developments will also contribute to additional urbanization. Social and community services will be affected, and several capital improvement projects will be required. Both local revenues and operating expenditures are expected to increase.

Land Use: Mining would alter 16,000 acres of land. Following currently proposed reclamation plans, 1,691 acres of cropland and 1,626 acres of ponderosa pine would not be restored. Mining activities would result in the short-term cessation of grazing; however, productivity of the areas after reclamation is expected to be higher than premine levels, though possibly less than the premine potential. The use of the conveyor system from Area C will result in a longer period of reduced production from the alfalfa field within the railroad loop crossed by the conveyor.

Transportation: Proposed development would cause an increase in road use, due to increased commuter traffic, and in rail use, due to increased coal production and transportation.

Recreation: Recreation resources in Colstrip and Rosebud counties are not currently sufficient to meet the projected recreational requirements as the population increases. Long-term recreational needs within Colstrip should be met by the additions proposed in Colstrip's master plan. Nonurban recreational resources that could be adversely affected would be the availability of deer populations for hunting.

Cultural Resources: Sixty-nine cultural resource sites lie within the mine area, and 57 of these would probably be destroyed or directly affected under current plans, Forty-one sites lie in the buffer zone; 16 of these could be indirectly affected by blasting.

Seven of the sites within the mining areas have been determined eligible for the National Register of Historic Places and an additional 50 sites appear to be eligible. four sites within the buffer zone area have been determined eligible and an additional four appear to be eligible for the National Register.

Aesthetics: The landscape would change in color, contrast, and texture due to the reduction or loss of ponderosa pine, shrub areas, and sandstone outcrops, none of which are unusual for the region.

RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

The proposed mine areas would produce a total of 376.7 million tons of Rosebud coal: 185 million tons from Area C would serve as the sole source of fuel for Colstrip Generating Units 3 and 4. Coal from Areas A and B would be sold to utilities in the upper Midwest, and coal from Areas E and D are dedicated to the Corette Generating Plant in Billings, Montana, and to Colstrip Generating Units 1 and 2.

Mining in Area E is projected for completion in 1984, Areas A and B in 1994, and Area D in 2004 (now projected for 2007). Mining in Area C would be completed in 2017. If the areas were not disturbed, they would continue to produce livestock forage, wildlife habitat, winter wheat, hay, marginal forest products, and scenery. All of these uses would be curtailed during mining, and crop production, timber production, wildlife habitat, and scenic value would be reduced after reclamation. Compared to premining conditions, productivity for livestock grazing would increase; however, the potential productivity of the postmined areas would be lower than the premining potential, primarily due to soil mixing.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The mine plan for each area assumes that only the coal from the Rosebud seam would be mined, leaving behind the lower quality coal contained in the McKay and Stocker seams. After mining of the Rosebud seam is completed, it is unlikely that the coal of the McKay and Stocker seams could be economically mined.

The existing stratigraphy in the mine areas would be permanently altered, and rock outcrops currently found in the areas would be removed, eliminating at least one site for a golden eagle nest. The existing topography would be altered, and mixing of overburden would alter the character and land use potential of the reclaimed surface. Successful establishment of conifers or shrubs is uncertain, and the potential for crop or timber production would be reduced. Vegetative diversity may also be reduced. Four sharptailed grouse dancing sites and numerous cultural resource sites would be removed or disturbed.

APPENDIX D

Biological Assessment of Threatened and Endangered Species

Biological Assessment for the Rosebud Area D Mine, Rosebud County, Montana, pursuant to Section 7 of the Endangered Species Act of 1973 as amended.

Prepared by the Western Technical Center, Office of Surface Mining, Denver, Colorado - June 27, 1983

Introduction

On April 15, 1983, OSM requested a species list from the U.S. Fish and Wildlife Service (USFWS), Billings, Montana for the Rosebud Area D Mine. On April 21, 1983, the USFWS responded with a list including the bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus anatum*) and the black-footed ferret (*Mustela nigripes*). OSM's biological assessment of the Rosebud Area D Mine's impacts on these species is presented below.

Proposed Action and Background

The proposed action is the approval of the permit application from Western Energy Company (WEC) to surface mine an area known as Area D in Rosebud County, Montana. Area D is part of the 22,000 acre Rosebud Mine complex near Colstrip, Montana and covers 3,363 acres of which 3,126 acres will be disturbed. Disturbance will occur in parcels over the period 1984-2008, and the area will be reclaimed to the post-mining land use of rangeland and wildlife habitat. A copy of WEC's fish and wildlife plan is attached as Appendix A.

Biological Assessment

Black-footed Ferret

The black-footed ferret is closely associated with prairie dog colonies where the ferret is largely dependent on prairie dogs as prey. The only documented prairie dog colony in the Rosebud Area is approximately four miles west of Area D. A 1979 survey of this town, following a recent snowfall, did not reveal ferret sign. Pete Martin, Montana Department of Fish, Wildlife and Parks (MFWP) stated that this colony has been poisoned over the past several years and that the potential for ferrets is low. Based on the absence of prairie dogs on the Area D site and the lack of ferret sign on the distant colony, OSM has determined that the proposed action will not affect the black-footed ferret.

Peregrine Falcon

This raptor migrates through the Area D region, but there are no recent sightings of a peregrine on the Rosebud site. Preferred nesting habitat, high cliffs near water, do not exist on or adjacent to the Area D site. In a 1983 survey of cliff-like habitat in the Colstrip area, John Ward, University of Wyoming, said that only crumbling outcrops were found in this area and these were being used by prairie falcons (*Falco mexicanus*). Migrating peregrines may rest or feed in the area while passing through; and, according to Pete Martin (MFWP), there was a sighting of a migrant in 1981, about four to five miles south of Colstrip.

The Rosebud Area D operation will disturb some rock outcrop and ponderosa pine habitat, and hence, potential perches for migrant peregrines. However, other perches are available and power poles associated with the mine are designed to be safely used by raptors. Mine disturbance and reclamation may alter the species composition of passerines in the area, but will not affect the food available to migrant peregrines. Based on this information, OSM has determined that the proposed action will not effect migrant peregrine falcons. WEC will include sightings of any peregrine falcons in their annual wildlife monitoring reports and OSM will continue to notify the USFWS of the report availability.

Bald Eagle

Information from WEC's wildlife surveys and conversations with biologists familiar with the Rosebud site indicate the nearest bald eagle nesting occurs over 25 miles away near the confluence of Rosebud Creek and the Yellowstone River, along the Yellowstone River and Tongue Rivers. There is no ducmented bald eagle nesting on or adjacent to the Rosebud Area D site. In addition, conversations with Mark Gorges, Bureau of Land Management in Miles City and Pete Martin (MFWP), indicated that there are no bald eagle winter roosts on or near the site.

It is possible that migrating or foraging bald eagles may use the Area D site occasionally since bald eagles are known to cover several miles when searching for food. WEC reported sightings of two migrant eagles in 1977 and one in 1981 in the Rosebud area. The Area D operation will disturb potential foraging habitat for eagles utilizing upland prey and carrion. However, the small acreage involved and the wide-ranging, opportunistic habits of the eagle make this short-term disturbance insignificant. Perch sites will still be available on the Area D site and power poles will be safe for resting or roosting eagles.

Based on this information, OSM has determined that the proposed action will not affect the bald eagle. Performance standards require WEC to report any sightings of bald eagles to the regulatory authorities, and OSM will continue to notify the USFWS when such reports are available.

Summary

OSM has concluded that the proposed action will not affect species protected by the Endangered Species Act or result in impacts on critical habitat.

References

Gorges, Mark, 1983, personal communication, Bureau of Land Management, Miles City, Montana

Martin, Pete, 1983, personal communication, Montana Department of Fish, Wildlife and Parks, Forsyth, Montana

Montana Department of State Lands and OSM, 1982, Final EIS, Rosebud Mine Area C

Office of Surface Mining, 1983, Draft comprehensive EIS, Western Energy Company's Rosebud Mine

Phillips, Bob, 1983, personal communication, USFWS, Sheridan, Wyoming

USFWS, 1978, Black-footed Ferret Recovery Plan

U.S. Geological Survey and Montana Department of State Lands, 1979, Draft EIS, Northern Powder River Basin Coal, Montana

Ward, John, 1983, personal communication, University of Wyoming

Western Energy Company, 1977, 1981, 1982, Wildlife Resources Reports for Rosebud Mine

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UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Billings Office
316 North 26th Street
Billings, Montana 59101-1396

IN REPLY REFER TO: (SE)

July 18, 1983

Memorandum

To: Robert Schueneman, Chief, Technical Support Branch
Office of Surface Mining, Denver, CO

From: Field Supervisor, Endangered Species, Billings, MT (SE)

Subject: Biological Assessment for Rosebud Area D Mine Permit Approval
Rosebud County, Montana

We have reviewed your biological assessment and decision on the Rosebud Area D Mine Permit Approval. Based upon the information you provided and other information available to us, we concur with your decision of no effect to listed species which may occur in the project area. If conditions change which may change your decision, we request that consultation with this office be reinitiated.

Thank you for your efforts to meet our joint responsibilities under the Endangered Species Act, as amended.

Wayne H Brewster

JUL 1983
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USDI OSM

LITERATURE CITED

Allen, E.O. 1968. Range use, foods, condition and productivity of white-tailed deer in Montana. Journal of Wildlife Management 32:1.

Amendola, F., M. Mitchell, and D. Simpson. 1984. Reclamation of tree and shrub species at the Absaloka Mine. In: Third Biennial Symposium on Surface Coal Mine Reclamation on the Great Plains. Bozeman, Montana: Reclamation Research Unit, Montana Agriculture Experiment Station, Montana State University.

Armstrup, Steven C. 1977. Effects of coal stripmining on habitat use, activities and population trends of sharp-tailed grouse (Pedioecetes phasianellus). Unpublished Progress Report, Denver Wildlife Research Center.

_____. 1978. Activities and habitat use of pronghorns on Montana-Wyoming coal lands. In: Proceedings of Eighth Biennial Pronghorn Antelope Workshop, Jasper, Alberta, Canada, page 277.

Blake, G. 1983. 1983 Annual Report: Reforestation studies at Colstrip, Montana. Colstrip, Montana: Unpublished report of Western Energy Company.

Brown, R.L. 1971. Sharp-tailed grouse. In: Game Management in Montana, ed. Mussehl, T.W. and R.W. Howell. Helena: Montana Department of Fish and Game.

Cole, Glenn F., and Bruce T. Wilkins. 1958. The pronghorn antelope: Its range use and food habits in central Montana with special reference to wheat. Technical Bulletin No. 2. Helena: Montana Department of Fish and Game.

Critchfield, H.J. 1966. General climatology. Englewood Cliffs, New Jersey: Prentice-Hall. 446 pages.

Dollhopf, D.J., J.D. Goering, C.J. Levine, B.J. Bauman, D.W. Hedberg and R.L. Hodder. 1981. Selective placement of strip mine overburden in Montana, V, summary report. U.S. Department of the Interior, Bureau of Mines, Report No. H0262032.

Dusek, Gary L. 1971. Range relationships of mule deer in the prairie habitat, north central Montana. Unpublished M.S. Thesis, Montana State University, Bozeman.

_____. 1976. Bull Mountains coal field study, Annual Progress Report, Helena: Montana Department of Fish and Game, pages 7-11.

Ecological Consulting Services, Inc. (ECON). 1973-1979. Baseline and monitoring wildlife reports for Western Energy Company's Rosebud Mine.

ECON. 1981. Western Energy Company vegetation report for mining Area D, 1980. Helena, Montana: Unpublished report submitted to Western Energy Company, Colstrip, Montana.

_____. 1982. Western Energy Company vegetation report for mining Area A, 1981. Helena, Montana: Unpublished report submitted to Western Energy Company, Colstrip, Montana.

_____. 1983. Western Energy Company vegetation report for mining Area C, 1982. Helena, Montana: Unpublished report submitted to Western Energy Company, Colstrip, Montana.

Gold, R.L. 1974. A comparative case study of the impact of coal development on the way of life of people in the coal areas of eastern Montana and northeastern Wyoming. Missoula, Montana: Institute for Social Science Research, University of Montana.

_____. 1975. A study of social impact of coal development in the Decker-Birney-Ashland area. Missoula, Montana: Community Service Program, University of Montana.

Herbort, Dale. 1981. Cultural resource inventory of developing areas near Colstrip, Montana. In: Herbort. 1982. Cultural resource inventory and assessment on Western Energy Company's proposed mining Area D. Butte, Montana: Mineral Research Center.

Herbort, Dale. 1982. Testing and assessment of four sites in WECO's Area D West. Butte, Montana: Report submitted to Western Energy Company by the Mineral Research Center.

Herbort, Dale. 1984. Cultural resource evaluations on Western Energy Company's proposed mining, Area D East. Report prepared for Western Energy Company by GCM Services, Inc., Butte, Montana.

Hibbert, A.R. 1981. Opportunities to increase water yield in the southwest by vegetation management. In: Interior West watershed management, ed. D.M. Baumgartner. Pullman, Washington: Washington State University, pages 233-230.

Holtzmann Associates. 1984. Coal Impact Designation Project. Preliminary technical report proposed for the Montana Coal Board.

Janson, R.G., et al. 1971. Ring-necked pheasant. In: Game management in Montana, ed. Mussehl and Howell. Helena, Montana: Montana Department of Fish and Game.

Jonas, Robert. 1966. Merriam's turkeys in southeastern Montana. Technical Bulletin No. 3. Helena: Montana Department of Fish and Game.

Knapp, Stephen J. 1972. Range use of mule deer prior to initiation of rest rotation grazing for cattle on the Fort Howes Ranger District, Custer National Forest, Montana. Unpublished M.S. Thesis, Montana State University, Bozeman.

Lesica, P., G. Moore, K. Peterson, and J. Rumely. 1984. Vascular plants of limited distribution in Montana. Monograph No. 2, Montana Academy of Sciences, Supplement to the proceedings, Volume 43. 61 pages.

Mackie, Richard J. 1970. Range ecology and relations of mule deer, elk, and cattle in the Missouri River Breaks, Montana. Journal of Wildlife Management 20:79.

Martinka, C.J. Habitat relationships of white-tailed and mule deer in northern Montana. Journal of Wildlife Management 32:3.

McKee, J.E., and H.W. Wolf. 1963. Water Quality Criteria, 2nd ed. Sacramento, California State Water Quality Control Board, publication 3-A. 548 pages.

Montana Board of Crime Control (MBCC). 1983. The impact of natural resource development on the criminal justice system. Helena, Montana.

Montana Board of Education. 1983. Accreditation standards for Montana schools. Helena, Montana.

Montana Department of Agriculture and Montana Crop and Livestock Reporting Service. 1972-1981. Montana agricultural statistics, County statistics. 1972-1981. Helena, Montana.

Montana Department of Health and Environmental Sciences (MDHES). 1984. Field investigation of Colstrip wastewater treatment plant. Unpublished survey. Helena, Montana.

_____. 1984. Field investigation of Colstrip water treatment plant. Unpublished survey. Helena, Montana.

_____. 1984. Montana health data book and medical facilities inventory. Helena, Montana.

Montana Department of Highways. Annual highway traffic counts. Unpublished. Helena, Montana.

Montana Department of Labor and Industry (MDLI). Monthly. Employment and labor force. Helena, Montana.

Montana Department of Revenue (MDR). Annual. Report of the state Department of Revenue. Helena, Montana.

Montana Department of State Lands (MDSL). 1980. Final environmental impact statement for Western Energy Company's Rosebud Mine, Area B extension. Helena, Montana.

_____. 1981. Final environmental impact statement for Western Energy Company's Rosebud Mine, Area E extension. Helena, Montana.

_____. 1983. Environmental impact statement, final addendum, Western Energy Company's Rosebud Mine, Area B, second extension. Helena, Montana.

Montana Department of State Lands and U.S. Office of Surface Mining. 1982a. Draft environmental impact statement for Western Energy Company's Rosebud Mine, Area C, Block 1. Helena, Montana, 308 pages plus appendixes.

_____. 1982b. Final environmental impact statement for Western Energy Company's Rosebud Mine, Area C, Block 1. Helena, Montana.

_____. 1983a. Final comprehensive environmental impact study for Western Energy Company's Rosebud Mine. Helena, Montana. 353 pages plus appendixes.

_____. 1983b. B5 Cumulative hydrologic analysis. Unpublished report prepared as technical support for the Final comprehensive environmental impact study for Western Energy Company's Rosebud Mine.

Montana Tax Foundation. Annual. Property tax mill levies. Helena, Montana.

_____. Annual. Montana taxation. Helena, Montana.

Mountain West Research Associates (MWRA). 1981. Proposed Montco Mine technical report. Billings, Montana: Unpublished report submitted to Montana Department of State Lands, on file in Helena.

Norbeck, P. 1984. Assessment of horizontal and vertical permeabilities for the Rosebud-McKay interburden, Rosebud Mine, Colstrip, Montana. Paper presented at the Canadian Land Reclamation Association meeting, Calgary, Canada, August, 1984, 13 pages.

Olson, Elliott, and Associates. 1980. Terrestrial wildlife inventory of the Montco Project Area. Final report to Montco, Billings, Montana.

OEA Research. 1981. CX Ranch baseline wildlife inventory. Final report to Consolidation Coal Company, Sheridan, Wyoming.

Patterson, R.C. 1952. The sage grouse in Wyoming. Denver, Colorado: Sage Brook, Inc.

Phillips, R.L. 1979. Winter distribution (1975-1978) of pronghorn antelope, mule deer and white-tailed deer in the Decker subregion of Montana and Wyoming. Unpublished Report, Denver Wildlife Research Center.

Pitcher, Ed. 1977. Peter Kiewit Sons' small mammal research program in Big Horn County, Montana, and Sheridan County, Wyoming, 1975-1976. Sheridan, Wyoming: Peter Kiewit Sons' Mining Company, pages 8-10.

Qamar, A., and R. Breuninger. 1979. Earthquake hazard to the proposed northern tier pipeline in Montana. Helena, Montana: Department of Natural Resources and Conservation, 54 pages.

Rives, C., M. Bajwa, and A. Liberta. 1980. Effects of topsoil storage during surface mining on the viability of VA mycorrhiza. Soil Science 129(4):253-57.

Rosebud County. Annual. Fifth budget document. Forsyth, Montana.

Running, S., J. Danielson, and N. Vance. 1983. 1983 Annual report--reforestation studies at Colstrip: Stress physiology. Colstrip, Montana: Unpublished report of Western Energy Company.

Schafer, W. 1984. Agricultural capability classification of pre- and post-mined landscaped in the Northern Great Plains. Journal Soil and Water Conservation, pages 270-273.

Schafer, W.M., G.A. Nielsen, D.J. Dollhopf, and K. Temple. 1979. Soil genesis, hydrological properties, root characteristics and microbial activity of 1- to 50-year-old strip mine spoils. U.S. Environmental Protection Agency, Report EPA-600/7-79-100, 211 pages.

Schumm, S.A., and R.F. Hadley. 1957. Arroyos and the semi-arid cycle of erosion. American Journal of Science 255: 161-174.

Severson, K.E., and M. May. 1967. Food preferences of antelope and domestic sheep in Wyoming's Red Desert. Journal of Range Management 20(1): 21-25.

Stark, N. 1982. The soils and ecology of establishing ponderosa pine on reclaimed lands. In: Symposium on coal mining and reclamation in the Northern Great Plains, pages B-4-1 to B-4-10. Bozeman, Montana: Montana Agriculture Experiment Station, Montana State University. Research Report 194.

_____. 1983. Physical and chemical problems with reclamation of conifers, Paper No. 83-2142. Presented at 1983 summer meeting of American Society of Agricultural Engineers, June 26-29, Bozeman, Montana.

_____. No date. Reclamation for conifers on calcareous soils in Montana. Missoula, Montana: Unpublished manuscript, School of Forestry, University of Montana, 12 pages.

Stearns, M.W., P.M. Norbeck, and P.M. Mellborn. 1983. Assessment of infiltration rates for disturbed and undisturbed sites at the Rosebud Mine, Colstrip, Montana. Proceedings of the third biennial plains aquatic research conference.

Swenson, Jon. 1981. The hardwood draws of southeastern Montana: Their importance to wildlife and vulnerability to man's activities. Proceedings of the 1981 Annual Meeting of the Montana Chapter of the Wildlife Society, Great Falls.

Thomas, J. et al. 1976. Guidelines for maintaining and enhancing wildlife habitat in forest management in the Blue Mountains of Oregon and Washington. Transcripts of the 41st North American and Natural Resources Conference, Washington, D.C.: Wildlife Management Institute.

Toy, T.J., and B.E. Munson. 1978. Climate appraisal maps of the rehabilitation potential of strippable coal lands in the Powder River Basin, Wyoming and Montana. Denver, Colorado: U.S. Geological Survey. 2 pages.

Trueblood, R., and J. Wergard. 1971. Hungarian partridge, pages 161-165. In: Game management in Montana, ed. Mussehl and Howell. Helena, Montana: Montana Department of Fish and Game.

U.S. Bureau of the Census. 1980. Census of population: Montana. Washington, D.C.

U.S. Department of Commerce, Regional Economic Information System (REIS). Annual. Employment and income estimates for Montana counties. Washington, D.C.: Unpublished.

U.S. Department of the Interior and Montana Department of State Lands. 1980. Final environmental impact statement, regional analysis, Northern Powder River Basin coal, Montana. Helena, Montana. 269 pages.

Van Voast, W.A., R.B. Hedges, and J.J. McDermott. 1977. Hydrogeologic conditions and projects related to mining near Colstrip, Southern Montana. Montana Bureau of Mines and Geology, Bulletin 102, 43 pages.

_____. 1978a. Strip coal mining and mined-land reclamation in the hydrologic system, southeastern Montana. Old West Regional Commission, Completion Report, 73 pages.

_____. 1978b. Hydrologic characteristics of coal-mine spoils, southeastern Montana. Montana University Joint Water Resources Research Center, Report No. 94, 33 pages.

Western Energy Company. 1979-1983. Wildlife monitoring reports for Rosebud Mine, Colstrip, Montana.

_____. 1983. 1983 annual hydrology report, Rosebud Mine, Colstrip, Montana: unpublished report, 26 pages.

_____. 1984a. Application for a surface mining permit, Area D. Billings, Montana.

_____. 1984b. Area D proposed amendment to air quality permit No. 1483.

Witkind, I.J. 1975. Preliminary map showing known and suspected active faults in western Montana. U.S. Geological Survey open-file TS-285.

Yoakum, Jim. 1980. Habitat management guides for the American pronghorn antelope. United States Department of Agriculture, Bureau of Land Management Technical Note 347.

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The following people (other than those cited in the text) provided information used to analyze Western Energy Company's mine plan:

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The Department of State Lands and Office of Surface Mining appreciate the assistance of Western Energy Company. The company provided the authors with information on the proposed mine and drafted most of the maps in the EIS.

REVIEW OF THIS STATEMENT

In accordance with environmental law, copies of this draft EIS will be made available to the public for comments and suggestions. All comments received will be carefully considered in the preparation of the final EIS. Comments can be sent to Commissioner Dennis Hemmer, Montana Department of State Lands, Capitol Station, Helena, MT 59620.

The draft EIs is available for review in the following places:

- Montana Department of State Lands, 1625 11th Ave., Helena, Montana.
- Big Horn County Public Library, 419 North Custer Ave., Hardin, Montana.
- Miles City Public Library, 1 South 10th, Miles City, Montana.
- The Rosebud County Library, 201 North 9th Ave., Forsyth, Montana.
- Parmley Billings Public Library, 510 North Broadway, Billings, Montana.
- Sheridan County Fulmer Public Library, 320 N. Brooks, Sheridan, Wyoming.

Copies are also available on request from the Department of State Lands, Capitol Station, Helena, Montana 59620, and from the Office of Surface Mining, Western Technical Center, Brooks Towers, Second Floor, 1020 15th Street, Denver, Colorado 80202.